MONTHLY WEATHER REVIEW,

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(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to October 20th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 131 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 195 monthly journals and 166 monthly means from the former, and 15 monthly means from the latter; 216 monthly registers from Voluntary Observers; 56 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from the local Weather Services of Iowa, Nebraska and Missouri, and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

The distribution of mean atmospheric pressure over the United States and Canada for the month of September, 1881, is shown by isobaric lines (in black) upon chart No. II. The area of lowest pressure covers the northern portions of the Upper Mississippi and Missouri valleys, in which regions the greatest departures from the normal for the month occur; within this territory the pressure ranges from 29.87 to 29.93. An area of 29.90 prevails over California, mean pressure ranging from 29.84 to 29.92. The area of highest mean pressure embraces the central and western portions of the South Atlantic states, extending thence northeastward along the Middle Atlantic, New England and Nova Scotia coasts; barometer ranging from 30.08 to 30.16. Compared with the preceding month the pressure is everywhere higher, by from 0.02 to 0.15 inch, except in the Upper Mississippi and Missouri valleys, and in California, where the fall is from 0.01 to 0.10 inch.

Departures from the Normal Values for the Month.—Compared with the means for previous years the mean pressure of the present month is everywhere below the normal, from 0.01 to 0.18 inch, except at scattering stations along the Atlantic coast where the excess ranges from 0.01 to 0.09 inch. The regions of greatest deficiency are found in the Upper Mississippi and Missouri valleys and in the Southern Pacific coast region. Stations reporting a normal condition are as follows: Key West, Baltimore, Philadelphia, Washington and Knoxville; those reporting a departure of but 0.01 inch: Charleston, Norfolk, Montgomery, Wilmington, Savannah, Augusta, Atlanta, Cincinnati, Buffalo, Detroit, Galveston, Shreveport, Red Bluff and Pioche.

Barometric Ranges.—The range of pressure for the month has generally varied from 0.5 to 0.7 inch, and in the extremes from 0.23 inch at Key West to 1.03 and 1.09 inches at Wilmington and Smithville respectively. Throughout the several districts the monthly barometric range varied as follows: New England, 0.52 inch on summit of Mt. Washington to 0.84 inch at Eastport; Middle Atlantic states, 0.39 at Cape May to 0.6 at Albany; South Atlantic states, 0.34 at Cedar Keys to 1.03 at Wilmington and 1.09 at Smithville; Eastern Gulf states, 0.23 at Key West to 0.56 at Montgomery; Western Gulf states, 0.39 at Indianola to 0.55 at Mason; Rio Grande valley, 0.36 at Brownsville to 0.45 at Brackettville; Ohio valley and Tennessee, 0.37 at Pittsburg to 0.84 at Indianapolis; Lower Lake region, 0.44 at Oswego to 0.63 at Toledo; Upper Lake region, 0.55 at Port Huron to 0.9 at Marquette and 1.05 at Duluth; extreme Northwest,

0.85 at Bismarck to 1.00 at St. Vincent; Upper Mississippi valley, 0.57 at Keokuk to 0.95 at St. Paul; Missouri valley, 0.63 at Leavenworth to 0.91 at Yankton and 0.92 at Huron, Dak.; Northern Slope, 0.66 at Cheyenne to 0.84 at Ft. Keogh; Middle Slope, 0.52 at Ft. Elliott to 0.75 at Dodge City; Southern Slope, 0.48 at Jacksboro to 0.66 at Ft. Griffin; Northern Plateau, 0.56 at Dayton to 0.74 at Missoula; Middle Plateau, 0.51 at Winnemucca to 0.58 at Salt Lake City. Southern Plateau, 0.4 at Silver City to 0.63 at Phœnix; North Pacific coast, 0.47 at Roseburg to 0.64 at Olympia; Middle Pacific coast, 0.47 at Red Bluff to 0.55 at Sacramento; Southern Pacific coast, 0.26 at Campo to 0.51 at Yuma.

Areas of High Barometer.—There was a general deficiency in pressure for the month, the most marked being in the Northwest. This distribution of pressure was associated with the southerly winds which prevailed for the month and with the unusually high temperature, which will hereafter be more fully described. Only four areas of high barometer were sufficiently marked to merit description.

No. I.—On the 4th, although the pressure continued below the mean there was a general rise of barometer in the Atlantic and Gulf states. The rise on the 5th, was confined to the South Atlantic and Gulf coast. On the 6th and 7th, the pressure was, in general, above the mean east of the Rocky Mountains. On the 8th, the region of high barometer was transferred to northwestern Texas and New Mexico. During the regime of this high pressure fair weather prevailed in the Middle, South Atlantic and East Gulf states and in Tennessee and the Ohio valley.

No. II.—On the 13th, there was a marked rise in pressure on the Pacific Slope which, on the 14th, extended over Idaho, Montana and Dakota; the barometer in Montana averaging 0.3 inches above the mean for the month. On the 15th, this area remained nearly stationary in position while low area No. IV was moving up the Mississippi valley. On the 16th, it disappeared before the advance of this storm into Minnesota.

No. III.—During the progress of low area No. IV, there was, on the 14th and 15th, a marked barometric rise in the Maritime Provinces of Canada and in New England. The pressure remained high until the 18th, and with slight change of location. The highest barometers reported were at the morning report of the 16th, Chatham, 30.60, or one-half inch above the normal; Sydney, 30.57; Halifax, 30.56; Eastport, 30.54. On the 15th and 16th, the pressure in this region averaged more than 0.4 inches above the mean for the month.

No. IV.—On the 27th, the barometer rose above the mean in the Missouri valley. On the 28th, the rise extended eastward to the St. Lawrence valley. On the 29th, during the passage of low area No. VII over the Northwest, the pressure rose in New England and Nova Scotia, the highest barometers being Eastport, 30.40; Halifax, 30.47, and Sydney, 30.46. On the 30th, with diminishing pressure, the centre of the high area was transferred to Virginia and North Carolina, while low area No. VII moved towards Hudson's Bay.

Areas of Low Barometer.—Seven such areas have been charted. The month is remarkable for the few storms of any energy which have affected the Atlantic coast of the United States. In the Lake region two storms (low areas Nos. II and VII) exhibited great energy. Low area No. VI is remarkable for the anomolous track pursued at different parts of its course.

No. I.—On the 4th, a great depression which had developed east of the Rocky Mountains moved over the Northwest. The lowest barometers reported were Yankton and Ft. Bennett, 29.43 or 0.6 inch below the mean, Duluth, 29.28 or 0.71 inch below the mean. On the 5th, the storm centre pursued an easterly track north of the Lake region, and on the 6th disappeared beyond the Gulf of St. Lawrence. During the passage of the depression no rain fell in front or south of the storm centre, but general precipitation was reported in the Northwest and Upper Lakes, after which the warm southerly winds veered to colder northwesterly. The maximum temperatures of the month, east of the Rocky Mountains, are associated with the march of this low area. The highest reported temperature was in Washington City, 104°. Cautionary signals were displayed in advance of this storm on the 4th on Lakes Superior, Michigan and Huron. The following maximum velocities were reported: Milwaukee, 30 S.; Grand Haven, 54 SW.; Port Huron, 25 W.

No. II.—On the 8th a depression moved to the eastward over Idaho and Montana, and on the 9th advanced beyond Dakota into Minnesota. On the 10th the storm centre passed over Lake Superior and into the Province of Ontario. On the 11th the low area moved beyond the Gulf of St. Lawrence. During the march of the storm centre there were no specially low barometric readings, nor was the barometric gradient at any time especially noteworthy, but the passage of the centre of low area was marked by very sharp falls of pressure followed at the subsequent observation by sharp rises. These sudden changes were accompanied by remarkably high winds for the Lake region. Cautionary signals were ordered to be displayed on the 10th for all the Lakes. They were generally justified by the following maximum velocities: Marquette, 35 W.; Escanaba, 25 SW.; Milwaukee, 38 SW.; Chicago, 25 W.; Grand Haven, 44 W.; Alpena, 26 W.; Port Huron, 27 W.; Toledo, 30 SW.; Sandusky, 44 W.; Erie, 27 W.; Buffalo, 28 SW. The precipitation of this storm was confined to the Northwest, Lake region and New England.

No. III.—At the morning report of the 9th a sharp fall in pressure and the circulation of the winds showed the existence of a storm centre menacing the North Carolina coast; during the

day a depression of great energy but of very slight diameter moved in a northerly track toward Norfolk. On the 16th, curving slightly to the northeast the storm passed beyond the coast. Cautionary signals were ordered in advance of this storm on the 9th from Smithville to Sandy Hook, and were justified by the following maximum velocities: Smithville, 60 NE.; Wilmington, 64 W.; Macon, 50 SW.; Hatteras, 42 SW.; Kittyhawk. 40 S.; Cape Henry, 35 SE.; Norfolk, 25 SE.; Chincoteague, 32 SE.; Barnegat, 28 N.; Sandy Hook, 30 NE.

No. IV.—This storm, which pursued a very anomalous track, was first evident in Texas, where on the 14th it moved in a track nearly due east. At the midnight observation, while the storm centre was near New Orleans, a barometric depression extended from the Gulf of Mexico to the Lake Superior region. At the same time the high pressure No. III, before described, prevailed with fair weather in New England. These conditions were unfavorable to an eastern progress of the storm, and on the 15th the depression moved in a northerly course to Lake Michigan. At the end of this day the pressure had not yielded in New England, and had begun to fall in the Northwest, the lowest barometers reported were, Chicago, 29.42; Grand Haven, 29.44; Milwaukee, 29.36, all more than 0.6 inch below the normal. On the 16th, with diminishing energy, the storm centre moved into Iowa and Minnesota, and on the 17th into Manitoba. The track on the 16th and 17th is very remarkable, and probably for a storm of such energy has no parallel in the history of the Signal Service. Cautionary signals were displayed on the 14th from Indianola to Pensacola, and on Lakes Michigan, Superior and Huron, and on the 15th on Lakes Erie and Ontario. The following maximum velocities were reported: Indianola, 40 N.; Galveston, 28 N.; Port Eads, 28 S.; Pensacola, 38 S.; Mobile, 28 SE.; Duluth, 78, NE.; Marquette, 30 S.; Milwaukee, 38 SW.; Grand Haven, 30 SE.; Alpena, 26 W.; Port Huron, 27 W.; Detroit, 39 SE.; Sandusky, 30 SW.; Cleveland, 26 SE.; Erie, 37 SE.; Rochester, 35 E.

No. V.—On the 23d, a depression exhibiting slight energy moved across Dakota into Minnesota. On the 24th, turning more to the north of east it moved with increased energy beyond the Lake Superior region. Nearly all the rain accompanying this storm was confined to the Northwest and the Upper Lake region. Cautionary signals were in general justified by the following maximum velocities: Duluth, 25 SW.; Marquette, 26 S.; Milwaukee, 34 SW.; Chicago, 27 SW.; Grand Haven, 33 SE.; Alpena, 36 S.; Port Huron, 27 S.; Detroit, 28 SW.; Toledo, 31 SE.; Sandusky, 32 SW.; Cleveland, 28 S.

No. VI.—On the 25th a depression developed in Wyoming and Nebraska. On the 26th the low area, showing but slight energy, moved into Wisconsin. On the 27th it advanced to the eastward beyond the lakes and on the 28th it disappeared beyond the Gulf of St. Lawrence. At no portion of its track did it become a storm of any violence. Its passage was accompanied by light rain fall, which extended to New England.

No. VII.—On the 28th, a low area developed in Dakota, which, on the 29th, moved in a northeasterly track across Minnesota. South of the track of the centre of depression there were sharp barometric gradients and considerable storm energy. The lowest pressures reported were: Omaha, 29.42; Fort Bennett, 29.38; Moorehead, 29.4; St. Paul, 29.46; Duluth, 29.3—all more than 0.6 inch below the mean. Cautionary signals, which had been ordered for the previous storm (No. VI) were kept displayed in consequence of danger menaced by the appearance of the new storm centre.

INTERNATIONAL METEOROLOGY.

International charts, Nos. V and VI, accompany the present REVIEW. The former is published for July, 1879, and continues the series of this chart commenced in January, 1877. Chart No. VI is prepared for the month of October, 1879, and continues the series of this chart commenced in November, 1877.

Chart No. V shows the mean pressure, temperature and the prevailing direction of the wind at 7.35 a. m., Washington, or 0.43 p. m., Greenwich mean time, for the month of July, 1879, over the Northern and at certain isolated stations in the Southern Hemisphere. To the areas of low pressure for the present month there attaches considerable interest, owing to their strikingly irregular boundaries over northern Europe. It will be observed, upon examination of the chart, that the lowest mean pressures are to be found over northern Hindostan, as indicated by the isobar of 29,50. Thence northward over the Himalayas and the western portion of the Chinese Empire, the barometer rises to 29.60, and north of Toorkistan and the Province of Tomsk, comprising the valley of the Obi and its tributaries, the pressure again rises to 29.70. Northwest of this locality, and within very narrow and irregular limits, the area of 29.70 passes over central Russia, southern Scandinavia and the northern portion of the British Isles. Between the meridians of 10° E. and 10° W., two small areas of 29.60 appear, one over the Shetland Islands and the other over the Hebrides. The area of 29.70 probably reaches the Asiatic coast in the vicinity of Pekin, but from lack of reports from central and eastern Siberia the lines on the coast cannot be connected with those of the interior. In Manitoba and along the southern shores of Hudson's Bay the barometer falls to near 29.80, and in one instance to 29.78 at Pembina, Dakota. Over the United States, west of the 100th meridian, the pressure is generally above 30.00; to the eastward and north of the 40th parallel, including Texas and Indian Terri-

tory, the barometer averages about 29.95. Between the parallels of 50° and 60° N., the pressure ranges from 29.55 to 29.95, and from 60° to 70° N., from 29.55 to 29.91. Over Asiatic Turkey and Persia, it falls below 29.80, with probably an area of 29.70 over Arabia. Over Hindostan the pressure ranges from 29.41 at Lahore to 29.71 at Poonah. The area of highest pressure, 30.30, covers the ocean between 30° and 40° N., and 20° and 50° W. The area of 30.10 occupies about three-fourths of the ocean between the parallels of 20° and 50° N., and the meridians of 10° and 70° W. The area of 30.00 occupies the southeastern portion of the United States and the extreme southwestern portion of Europe; the barometer over the latter being generally below 29.90. The following are the highest readings from isolated stations: Angra, 30.33 (770.3); Ponta, Delgado, 30.31 (769.8); Capetown, 30.16 (766.0); Funchal, 30.14, (765.5); Mauritius and Melbourne, 30.13 (765.2); Mexico, 30.10 (764.4). The extreme monthly range of mean pressure is 0.94 inch, which is 0.03 inch smaller than July, 1878, and 0.02 inch larger than July, 1877. The following monthly mean temperatures are given in Fahrenheits scale: lowest Godthaab, 44°; Ft. St. Michaels, 47°; Stykkisholm, 51°; York Factory, 55°; Nikolaievsk on the Amoor and Moose Factory, 60°: highest, Lahore, 99°; Laghouat, 98.°1; Nukuss, 90.°7; Tiflis and Tashkend, 90.°5; Beirut, 90°. The prevailing direction of the winds over the United States, was *southwesterly* in the Atlantic coast states, *southerly* over the interior and in the Plateau regions, *westerly* in the Northwest and Lake region, and variable on the Pacific coast. Over the Atlantic ocean, *northeast to southeast* and *southwest* south of parallel 40° N., and to the northward from *southwest* to *northwest*. Over Europe, *northerly* in Scandinavia, *northwest* to *southwest* over the British Isles, *westerly* in the interior, and *north* to *west* in Italy. In Algeria, *variable*. In Hindostan, *southwest* to *northwest*. Along the Asiatic coast, *southeast* to *southwest*. Compared with July, 1877 and 1878, the temperature over the United States agrees very closely in the interior, but is somewhat lower along the northern boundary, in the Southern Plateau and Southern Pacific coast regions, and higher along the Gulf coast. The pressure is slightly higher to the south and east and in the Lake region and Northwest, elsewhere about normal. Over the Atlantic ocean where comparison can only be made with 1878, the pressure at the central area of high (in the vicinity of the Azores) is from 0.01 to 0.03 inch higher. The area of 30.10 has moved considerably to the southeast, causing a marked fall along the western coasts of France and the British Isles, and over the Bay of Biscay. Off the eastern coast of the United States, the changes in temperature and barometer are very slight. North of parallel 50° there is a marked rise in the barometer west of 30° W., but a decided fall to the eastward. With regard to temperature the changes are unimportant except in the last named locality, where there occurred a fall of from 3° to 5°. In Europe the greatest changes in pressure occur in the central and southern portions and over the British Isles, where in the latter a decided fall is reported of from 0.05 to 0.30 inch. This deficiency extends southward over Algeria, and eastward through Russia to Central Siberia; thence to the Asiatic coast, there was first a rise and then a fall, the latter occuring along the China coast. Accompanying this general diminution of pressure there is a considerable rise in temperature, except over the British Isles, where a fall of from 2° to 4° occurs. In Hindostan, there is a general but slight fall in pressure, accompanied by a corresponding rise in temperature. The accompanying table shows the dieviations in temperature and barometer at isolated stations for the month of July, 1879, as compared with the means of the past two years.

Comparative Thermometric and Barometric Means, with corresponding Departures.

Station.	Mean Temperature.			Mean Barometer.			Station.	Mean Temperature.			Mean Barometer.		
	July, 1877-78.	July, 1879.	Departure.	July, 1877-78.	July, 1879.	Departure.		July, 1877-78.	July, 1879.	Departure.	July, 1877-78.	July, 1879.	Departure.
	°	°	°					°	°	°			
York Factory	58.2	54.6	−3.6	29.75	29.90	+0.15	Ponta Delgado	74.4	76.6	+2.2	30.34	30.31	−0.03
Fort St. Michaels	49.1	47.2	−1.9	29.82	29.86	+0.04	Angra	72.4	74.3	+1.9	30.33	30.33	Norm'l
Godthaab	44.2	44.1	−0.1	29.74	29.91	+0.17	Bridgetown	83.0	81.2	−1.8	29.99	29.98	−0.01
Stykkisholm	51.7	51.1	−0.6	29.73	29.86	+0.13	Navassa	82.7	81.3	−1.4	29.92	29.98	+0.06
Tromso	53.9	56.1	+2.2	29.73	29.78	+0.05	Medellin	67.4	66.1	−1.3	.....	.....	.....
Thorshavn	54.6	53.1	−1.5	29.76	29.74	−0.02	San Jose de Costa Rica	66.2	66.7	+0.5	.....	.....	.....
Archangel	61.3	59.7	−1.6	29.97	29.72	−0.25	Mexico	59.3	56.3	−2.0	30.10	30.06	−0.04
Ekaterinburg	71.1	70.9	−0.2	29.66	29.63	−0.03	Melbourne	48.6	46.8	−1.8	30.15	30.13	−0.02
Barnaul	70.0	79.5	+9.5	29.65	29.59	−0.06	Hobart Town	51.8	42.3	−9.5	29.95	29.98	+0.03
Yeniseisk	70.4	76.8	+6.4	29.38	29.70	+0.12	San Jose de Puerto Rica	82.8	83.1	+0.3	29.98	30.05	+0.07
Nikolaievsk, on the Amoor	57.5	59.7	+2.2	.....	.....	.....	Nassau	83.8	84.0	+0.2	30.03	30.06	+0.03
Pekin	81.8	78.8	−3.2	29.65	29.64	−0.01	Havana	82.5	82.5	N'm'l	30.02	30.04	+0.02
Zi-Ka-Wei	77.6	80.8	+3.2	29.75	29.71	−0.04	Astrakhan	85.2	87.8	+2.6	29.79	29.79	Norm'l
Tokei	77.1	76.3	−0.8	29.87	29.90	+0.03	Athens	87.7	89.6	+1.9	29.90	29.84	−0.06
Tashkend	86.9	90.5	+3.6	29.78	29.60	−0.18	Lahore	97.4	99.1	+1.7	29.44	29.41	−0.03
Nukuss	89.9	91.7	+1.8	29.76	29.75	−0.01	Tiflis	88.4	90.5	+2.1	29.75	29.74	−0.01
Beirut	89.6	90.3	+0.7	29.78	29.73	−0.05	Laghouat	97.9	98.1	+0.2	30.10	29.98	−0.12
Mauritius	71.7	72.1	+0.4	30.18	30.13	−0.05	Monach Lighthouse	58.9	54.2	−4.7	29.85	29.55	−0.30
Fort Napier	69.6	63.7	−5.9	30.01	30.01	Norm'l	Fort de France	80.8	79.7	−1.1	29.89	29.86	−0.03
Cape Town	61.0	61.4	+0.4	30.12	30.16	+0.04	Yokohama	77.4	76.7	−0.7	29.83	29.90	+0.07
Free Town	81.4	79.7	−1.7	30.02	29.98	−0.04	Lisbon	77.0	75.0	−2.0	30.07	30.10	+0.03
Paramaribo	82.9	79.8	−2.1	30.03	30.02	−0.01	Madrid	88.3	90.1	−1.8	29.94	29.89	−0.05
Funchal	74.4	74.8	+0.4	30.16	30.14	−0.02	Cagliari	82.9	79.0	−3.9	29.96	29.98	+0.02

Chart No. VI.—This chart displays the tracings of the probable courses of twenty-three of the principal storm areas of the Northern hemisphere for the month of October, 1879. The approximate paths of progressive movement are based upon daily simultaneous international observations to the number of over 650, besides a large mass of irregular data which reaches this office in various ways from logs of vessels of the merchant marine of the North Atlantic ocean. Concerning the general distribution of the paths of the areas of low barometer the following is given: Only three areas were confined within the boundaries of North America, although six others crossed portions of that continent, two coming from the Pacific, two from the Atlantic, one from the Rocky Mountain region between the parallels of 40° and 50° N., and one from Manitoba, the latter crossing the ocean to the mainland of Europe. Three areas were confined to the Atlantic between the 30th and 50th parallels. Seven areas reached the mainland of northern Europe from the Atlantic between the parallels of 60° and 70° N. Two areas were confined to southern Europe, one to the Bay of Biscay and northern Spain and one to southern Russia. Of the storms of North America the following descriptions are given: No. I formed over the northern Rocky Mountain region on the 1st and moved thence northeastward during the day to Lake Superior, accompanied by brisk south to west winds and light rains. During that portion of the storm's course eastward over Canada and the Marime Provinces, fresh to brisk winds were experienced, with the centre of depression moving very rapidly and accompanied by slight precipitation. By morning of the 4th the depression, with considerably diminished energy, had reached the Atlantic in the vicinity of 50° N., 50° W., followed over the Maritime Provinces by brisk to high westerly winds and rapidly rising pressure; on this and the preceding day there began the formation of an area of barometric minima over the ocean between the parallels of 40° and 50° N. and the meridians of 30° and 60° W., which continued about stationary until the 29th; 4th, in 47°, 30′ N., 45° W., 29.73 W. force 6, on the Banks of Newfoundland. steamship *Alabama* took heavy northerly gales which lasted until the 12th; in 50°, 46′ N., 26°, 08′ W., WSW., S. and NW. fresh to strong gales and high sea; in 49°, 05′ N., 27°, 09′ W., S. and NW., strong gales. 5th in 50°, 18′ N., 32°, 13′ W., NNW. to WSW., fresh gales to moderate breezes, high seas; in 44° 50′ N., 42°, 50′ W., strong SW. gales; in 45°, 35′ N., 50°, 10′ W., 29.83, NNW., force 8, rain. 6th in 46°, 38′ N., 39°, 44′ W., SW. to NW., fresh to strong gales, clearing away at 8 p. m.; in 51°, 10′ N., 31°, 36′ W., fresh to moderate S. to SE. gales, with rain. 7th, in 48°, 36′ N., 33°, 20′ W., strong SE. gales with hard squalls, torrents of rain and heavy seas sweeping decks; in 51° N., 37° W., 29.80, S., force 3, rain. Area No. V, to be described further on, is in all probability a continuation of this storm. No. III. After the passage of area No. I to the Lake Superior region the barometer again fell over Montana and Wyoming, developing on the 3rd an area of slight energy which moved rapidly northeastward to Manitoba, where on the morning of the 4th the lowest barometer, 29.64, occurred at Fort Garry. On the 5th this area gradually filled up over Hudson's Bay. No. IV. This area first appeared over the Pacific ocean on the 3rd in the vicinity of 44° N., 140° W., and moving thence slowly eastward, reaching the coast of Oregon and Washington Territory on the morning of the 6th; Olympia, 29.43, S. rain; Portland and Roseburg, 29.45, SSE. and SE., cloudy. During the day the depression moved southeastward and on the following morning was central between Virginia City, Montana and Salt Lake City; barometer at former 29.33, wind NW., at latter 29.55, S. Morning of the 8th, central with lower pressure in the Middle Rocky Mountain slope; North Platte, 29.22, SE; Dodge City, 29.36, S.; Cheyenne, 29.76, NW.; Denver, 29.73, NE. With increased energy the depression moved northward to Manitoba, where on the morning of the 9th the lowest barometer, 29.44, was reported from Fort Garry; rain, with fresh to brisk winds, prevailed along the northern border of the country eastward from the 100th meridian to the Pacific coast. On this morning a barometric trough extended southward from Manitoba to the Rio Grande valley, with the lowest reading at North Platte, 29.29, wind NNW. High winds were experienced at Rocky Mountain stations as follows: Pike's Peak, SW. 78 miles; Cheyenne, W. 50 miles. During the 9th the pressure rapidly recovered to the south and west and on the morning of the 10th the centre of depression lay to the north of Manitoba, where during the day it disappeared over Hudson's Bay. No. IX.—With a very sudden and rapid fall in the barometer, this depression appeared on the Oregon coast on the morning of the 11th. During the two following days the area passed southeastward into northern New Mexico, followed over Nevada by cold northwesterly winds and light snow at places. On the 14th the depression curved to the north-northeast, being central in Colorado on the following morning with a decided fall in pressure. By morning of the 16th, was central in the Upper Missouri valley from whence its course changed to the east-southeast, uniting with area No. VIII on the 17th in central Wisconsin. Accompanying this combination there was in consequence no marked change in the barometer or coincident increase of wind velocity. The central area still remained within the isobar of 29.60 and light rains, with fresh to brisk winds prevailed over Lakes Michigan and Superior. On the 18th, with increasing pressure the area was central over the Province of Ontario, followed over the Upper Lakes by brisk to high westerly winds and accompanied over the Lower Lakes and Province of Quebec by fresh to brisk southeast to southwest winds and light rains. Morning of the 19th, central over eastern Maine and New Brunswick, lowest barometer at Chatham and Eastport, 29.68 and 29.69

respectively. 20th, central with diminished pressure over the ocean south of Newfoundland in vicinity of 43° N., 60° W. and thence northeastward over Newfoundland the barometer ranged from 29.12 to 29.72, lowest at St. Pierre, N. F., with west and northwest winds varying in force from 3 to 9. The isobar of 29.60 inclosing the central depression on this day extended northeastward to Iceland, thence southeastward over Ireland to northern Italy and again northeastward over central Russia to northwestern Siberia, north of which line the pressure rapidly diminished to the Arctic ocean. On Cariboo Island, N. S., violent northwest storm all day, several vessels wrecked; in 46°, 36′ N., 55°, 23′ W., S. S. *Faraday*, 29.20, violent westerly gale; in 41°, 25′ N., 56°, 30′ W., S. S. *Spartan*, heavy NW. gale for 24 hours; in 40° N., 57° W. violent W. and NW. gales. 21st, depression central east of Newfoundland; at St. Johns, 29.36 W. strong, a fall of 0.15 inch in past 24 hours; St. Pierre, N. F., 29.56 NW.; in 43°, 50′ N., 55° W., 29.87, NW., force 6, rain; in the vicinity of 40° N., 69° W., the barometer rose from 0.40 to 0.50 inch in 24 hours, wind steady northwest; in 45°, 12′ N., 52°, 20′ W., S. to NW. fresh gale, heavy sea; in 48°, 56′ N., 39°, W., SSW. to WSW. strong gales, high seas; in 45°, 43′ N., 51°, 19′ W., SSW. to W., increasing to moderate gale; 22nd, central in about 55° N., 35° W., barometer generally below 29.75. On the following day combined with area No. XV, then central northwest of Iceland; barometer at Stykkisholm 29.25, SE., force 6, rain. No. VIII.—This storm of cyclonic origin first appeared over the Caribbean sea, in the vicinity of 15° N., 65° W., during the 10th and 11th. During the 24 hours preceding the morning of the 12th, the pressure at all West India stations east of Havana fell from 0.02 to 0.05 inch, winds shifting from east to southeast; up to the 13th, land stations, so far as shown upon our charts, gave but little indication of the development of the storm, the narrow diameter of the central area being as usual well marked. Reports from Havana on the 12th stated that there were indications, from incoming vessels, of a severe cyclone to the southeast. The following reports on the 12th show more clearly the effect of the approaching storm from the relative disposition of wind directions and the heavy rainfalls than the accompanying distribution of pressure. S. S. *Vandalia*, Chiriqui, C. A., 29.85, SW.; Navassa, 29.79, SE., rain, 2.59 inches rain-fall in past 24 hours; Santiago de Cuba, 29.79, SE., cloudy; Kingston, Jamaica, 29.99, SE., cloudy, 8.10 inches rain-fall in past 24 hours; Nassau, 29.92, NE., fair; Havana, 29.86, NE., cloudy; 13th, Kingston, Jamaica, 30.04, SE., rain, 5.50 inches rain-fall in past 24 hours; Navassa, 29.76, E., threatening, 1.59 inches rain-fall in past 24 hours; Santiago de Cuba, 29.83, SE., no report of weather; Havana, 29.75, E., cloudy; Key West, 29.85, E., heavy rain; Nassau, 29.91, NE., cloudy. Schooner *Olive Branch* wrecked at Barnett Point, Great Bahamas. Sandy Cay, Great Bahamas, bark *Pahona* stranded at 1.30 p. m., during a heavy easterly gale. Cienfuegos, Cuba, at 6 p. m., barometer fell to 29.65, lowest, then rose gradually to 29.90 on the 18th; wind NE. from the 10th to 10 p. m. of the 13th, when it changed to ESE. and SE.; Baracoa, Cuba, barometer fell from 29.84 at 9 a. m., of the 10th to 29.67 by 4 p. m., of the 12th, then rose to 29.84 by 9 a. m. of the 14th; wind ESE. on the 10th, 11th, and up to 9 a. m. of the 12th, at 4 p. m. changed to SSE; 13th S., fresh and squally. Sagua la Grande, Cuba, barometer fell from 29.88 at 8 a. m. of the 12th to 29.72 by 4 p. m. of the 14th, and then rose to 29.90 by 8 a. m. of the 16th; wind E., force 5 to 7 on the 12th and 13th; ESE. and SE., force 5 and 6 on the 14th; SSE. to S. force 2 to 6 on the 15th. 14th, depression appeared to be central over the southwestern portion of Cuba, Havana, 29.65, E., light rain; in 24° N., 84° W., 29.64, NE., force 8, cloudy; Key West, 29.74, E., light rain, 3.29 inches rain-fall in past 24 hours; Punta Rassa, 29.86, a fall of 0.07 inch in past 24 hours, NE., light rain; Kingston, Jamaica, 30.11, SE., cloudy, 4.80 inches rain-fall in past 24 hours. 15th, central over the eastern portion of the Gulf of Mexico, in about 25° N., 85° W. Havana, 29.73, SE., cloudy; Key West, 29.75, SE., cloudy; Punta Rassa, 29.76, E., light rain; Kingston, Jamaica, 30.17, hazy, 3.40 inches rain-fall in past 24 hours. Along the northern Gulf coast the winds were northeasterly, with occasional light rains, and the barometer had fallen from 0.09 to 0.20 inch since the morning of the 14th. 16th, depression central with diminished energy, in southern Mississippi; Mobile, 29.62, W., cloudy; New Orleans, 29.73, NW. cloudy; Montgomery, 29.69, SE. light rain, 2.19 inches in past twenty-four hours; St. Marks, 29.83, E., cloudy, 2.93 inches in past twenty-four hours. During the day area passed northward over the Mississippi valley, combining with area No. IX, then central in Wisconsin on the morning of the 17th. No. XVII.—Following closely upon an area of high pressure (30.30) which succeeded the passage of area No. IX, the winds shifted from NW. to S. with a decided fall in pressure over Manitoba by morning of the 19th. By morning of the 20th the barometer at Fort Garry had fallen from 30.32 on the 18th, to 29.69, and the isobar of 29.80 included nearly the whole of the extreme Northwest. 21st, central in the northern portion of the Upper Mississippi valley, but accompanied by no precipitation. 22nd, central over Lake Superior; Marquette, 29.69. W., fair; Duluth, 29.86, NW., light rain; Moose Factory, 29.67, S., fair. 23d, central with decreased pressure over the Province of Quebec, and by the following morning reached the Gulf of St. Lawrence; lowest barometer at Charlottetown P. E. I., 29.56; light to heavy rains prevailed in New Brunswick, Nova Scotia and adjoining islands. On this day accompanying the rapid rise in barometer over the Province of Ontario, light to heavy snow fell at several stations, with winds shifting to northwest and the thermometer ranging from 25° to 31°. During the 24th and 25th, area passed northeastward to near 60° N., 40° W. The

following reports from Godthaab show the effect of the northward movement of the storm: 24th, 29.45, a fall of 0.42 inch in past twenty-four hours, wind S., cloudy; 25th, 29.14, NE., cloudy; 26th, 29.38, SSE., cloudy; 27th, 29.42, calm. During the approach and passage of the depression over Iceland, the following reports from Stykkisholm show the effect: 26th, 29.60, a fall of 0.47 inch in past twenty-four hours, wind S., force 9, rain; 27th, 29.65, W., force 9; 28th, 29.78, SW., force 2. On the 28th Thorshavn reported a fall of 0.14 inch in the barometer, winds shifting from SW. to W., and at North Unst, a fall of 0.12 inch. Rain began on the Norway coast with a fall in pressure of from 0.07 to 0.20 inch. 29th, depression probably central over northern Lapland; Tromso, 29.52, WSW., cloudy. 30th, central over the White Sea; Archangel, 29.59, a fall of 0.25 inch in past twenty-four hours. During the 31st disappeared in a high pressure area (30.40) then prevailing over Siberia. No. XX.—During the prevalence of an extremely high pressure area (30.80) over the Middle Atlantic States, and 30.60) over the South Atlantic States on the 25th and 26th, the barometer, over the central portion of the Gulf of Mexico, fell below 29.90. Bark *Henrietta*, 150 miles SSE, of Port Eads, La., experienced during the 26th and 27th, heavy gales from ESE. to NE., with fearful sea. Brig *Sally* left Pensacola, Fla., for Havana, on the 25th; 26th, wind increased to a terrific gale, heavy seas sweeping decks; 27th, vessel thrown on beam ends about 8 a. m. and capsized about one hundred miles SE of South Pass Light, six sailors lost; sea continued very rough and dangerous throughout the 28th. As early as the 24th, reports from Havana stated that there were indications of a cyclone forming to the northwest. Schooner *L. B. Wing*, from Pascagoula to Sagua la Grande was struck by a violent easterly gale on the afternoon of the 25th and became water-logged. 27th, along the northern Gulf coast, the wind changed to NE. and N. with light rains, barometer still above 30.20; in 23°, 45′ N., 90°, 15′ W., 29.92 S.; Key West, 29.98 E., 3.33 inches rain-fall in past 24 hours; in 26° N., 86° W., bark *Jennie Armstrong*, 26th, struck hurricane from E. and was compelled to scud before it under bare poles; 27th, gale changed to NE., which drove the vessel back off Galveston harbor. In 16° N., 87° W., 27th, schooner *Mary Evelin* encountered violent southwesterly gale, lost sails and sprung a leak. Brig *Nellie*, 24 miles off Southwest Pass, lost sails and sprung a leak during violent easterly gales. During the day the depression passed rapidly northeastward across northern Florida to the Atlantic, the barometer along the South Atlantic coast, falling from 0.25 to 0.60 inch, winds NE. and N. Heavy gales were experienced over the ocean west of the 70th meridian. In 31°, 47′ N., 71°, 16′ W. brig *Victoria* experinced hurricane from SW. to WNW. lasting 3 days, lost sails. In 32° N., 73° W. brig *John Wesley*, hurricane from SE. backing to NE. and N. and again around the compass, lasting 18 hours. 28th, depression probably central off the North Carolina coast; Cape Hatteras, 29.79 NE. light rain, a fall of 0.61 inch and 3.18 inches rain-fall in past 24 hours. In 37° N., 57°, 30′ ship *Red Cloud* in hurricane from SSE. lost sails. 60 miles north of the Bermudas, brig *Terifa* had terrific gale from SE. to SW. with heavy cross seas throwing vessel on beam ends and forced to run before the gale for 8 hours. In 39° N., 66° W. heavy gale from E. to S. veering to WNW. and continuing for 40 hours. During the day depression passed rapidly northward off the Middle Atlantic coast and by morning of the 29th had combined with area No. XXI then central on the New England coast. No. XXI. On the 26th there were indications of the approach, southeastward, of an area of low pressure from the region north of Manitoba; at York Factory the wind shifted to SE. and the barometer had fallen 0.22 in the past 24 hours. By morning of the 27th the depression appeared central north of Lake Superior, barometer at York Factory indicated a fall of 0.36 inch, wind shifting to W., with light snow; Moose Factory, 29.66, SW., a fall of 0.34 inch in past 24 hours. During the day the depression changed its course to the southeast and by morning of the 28th was central north of Lake Erie; lowest barometers at Alpena and Parry Sound, 29.38 and 29.40, respectively; over the Upper Lake region the winds shifted to W. and NW. increasing to brisk and high accompanied by light rains. 29th, depression central in Maine, lowest barometer at Eastport, 28.77, a fall of 1.10 inches in past 24 hours or 1.16 inches below the normal reading for the month. At midnight the barometer at Sydney, C. B., read 28.73 or 1.16 inches below the normal, a fall of 1.23 inches in past 24 hours. In this vicinity a combination with area No. XX, as heretofore noted, produced a most remarkable change in the pressure and enlarged to a vast extent the area of barometric minima. Inclosed by the isobar of 29.60 the depression covered 20° of latitude and 25° of longitude. In the disposition of pressure over the North Atlantic, Canada and the northeastern portion of the United States a remarkable coincidence occurred on this date, as follows: The isobar of 29.80 inclosed three separate centers of barometric minima between the meridians of 30° and 95° W. and the parallels of 35° and 55° N. The situation and lowest readings of these centres are given as follows: 29.60 in about 46° N. 34° W.; 28.77 at Eastport, Me., and 29.26 at Marquette, Mich. The first and third barometric minima belong to areas No. XIX and No. XXII, respectively. Returning to the position of area No. XXI at Eastport on the morning of the 29th it is found that heavy rains, with high to hurricane southeast to southwest and northwest winds, prevailed over Maine, New Brunswick, Prince Edward Island and Nova Scotia. The highest wind velocities and heaviest rain-falls of the month were experienced on this date at stations in New England and the Canadian Maritime Provinces: Mt. Washington, 132 miles NW.; Newport, R. I., 44 W.; Thatcher's Island, 57 W.; Eastport, 48

NE.; Boston, 39 W.; St. John's, N. B., SE. to NW., strong gales—nothing like this storm for many years; Yarmouth, N. S., strong SE. to NW. gales, terrific squalls; Halifax, SE. to W., violent gales; Port Hastings, N. S., terrific hurricane from SE. to NW.; Louisburg, N. S., heavy ESE. gale veering to S. and WSW.; Cow Bay, N. S., strong SE. to SW. gales; Glace Bay, N. S., heavy SSE. to W. gales; Sydney, N. S., violent SE. gale; Pictou, N. S., strong SW. gale; Charlottetown, P. E. I., heavy NE. to SE. gales; Point du Chene, N. B., heavy SE. to NE. gales—tide suddenly rose three feet, carrying everything before it and causing very great damage; Chatham, N. B., violent E. storm—tide rose suddenly, carrying away bridges and flooding houses; Dalhousie, N. B., fearful gale from the E.; Percé, P. Q., very heavy gale from E. shifting to W; Father Point, heavy NE. gale, 72 miles per hour; Port Mulgrave, terrific hurricane, doing immense damage to buildings and houses; Hawkesbury, terrific gale from the sea, lasting three hours; Antigonish, terrific gale raged for hours, equalling in violence that of August, 1873; Shelburne, heavy SE. gale; Lockport, extremely violent SW. gale; St. Peters, C. B., as violent as that of August, 1873; Magdalen Islands, violent E. gale, veering to SE. and blowing a perfect hurricane for 12 hours; Broad Cove, C. B., severest gale ever known; New Castle, unusually high tide, flooding lower part of town; Cocagne, tide rose higher than ever known before, rising six feet higher than the highest point during the great storm of August, 1873; Alberton, P. E. I., highest tide ever known. Along the coasts of the Canadian Maritime Provinces over 100 vessels were driven ashore or badly damaged during the storm. The following reports are from vessels along the coast or at sea: Off Nantucket South Shoals, violent NW. gale and heavy cross seas; off Isle Haute, violent squalls and heavy sea; off Sable Island, hurricane from S., veering to E., lasting several hours, followed by a calm, continuing for 15 minutes, when the wind changed to west, blowing with greater violence than before; in 34° N., 70° W. violent SW. gale, lasting six hours with very heavy sea; in 42°, 32′ N., 59°, 06′ W. cyclone from ESE. to W., with fearful sea; in 40° N., 62° W. hurricane from SW. to W., lasting 12 hours; in 43°, 16′ N., 60°, 17′ W. violent NNW. to ESE. and W. gales; in 41°, 43′ N., 71°, 53′ W. S. to WNW. strong gale, heavy sea; in 42°, 15′ N., 59°, 49′ W. hurricane from S; in 40°, 48′ N., 60°, 45′ W., heavy cyclone from SSW. backing to SE. and then veering to SSW., lasting two hours, at 6 p. m. had a lull of 30 minutes, barometer rose from 28.60 to 29.10, when a terrific hurricane broke out from the W., sea mountains high, ship completely buried, sails went like a cannon shot, roar of wind was deafening for 2 hours followed by a high westerly gale for 3 days; in 41° N., to 60° W. hurricane from SW. to NW. and continuing for 16 hours; off George's Shoals, heavy gale from SE. to W. and NW., lasting twenty hours; in 44°, 42′ N. 60°, 05′ W. hurricane at 6.30 a. m.; 9 a. m. vessel thrown on beam ends; in 42°, 20′ N., 61°, 50′ W., strong gale from SSE. to ESE.; 6 p. m., lull for five minutes when wind suddenly veered to SW. with hurricane force, sea broke completely over the vessel carrying away everything; in 40° N., 63° W., hurricane from SW. to NW., lasting three hours; in 40° N., 60° W., gale from S. to NW., lasting twelve hours; in 37°, 40′ N., 62°, 30′ W., hurricane from S. veering to WNW. and lasting several hours; in 41°, 58′ N., 64°, 29′ W., heavy gale from SSE., veering to W. During the 29th this storm passed northward over the Gulf of St. Lawrence, combining on the following morning with area No. XXI then central in the Lower St. Lawrence valley. No. XXII, after the passage of No. XXI eastward to the Province of Ontario by morning of the 28th, the barometer still remained below 29.80 in Manitoba and the extreme Northwest with westerly winds, light rains and snow; lowest barometer 29.73 at Pembina, air calm. Morning of 29th depression central over Lake Superior, lowest barometer 29.26, wind W., at Marquette; following the movement of the area on this day, light rains and snow with brisk to high southwest to northwest winds prevailed in the extreme Northwest, Upper Lake region and Province of Quebec. During the day centre passed rapidly eastward over Canada, and by the following morning was central over the Gulf of St. Lawrence, with the pressure below 29.60 between the meridians of 37° and 80° W., and the parellels of 40° and 55° N.; Father Point, 29.19, W., light rain; Windsor, N. S., 29.17, SW., cloudy; Dalhousie, N. B., 29.20. light rain; in 51° N., 56° W., 29.16, NE., cloudy; steamer *Croft*, on the morning of 30th, while standing off the Banks of Newfoundland, experienced strong breeze from the W., which increased to a hurricane within one hour, sea confused and dangerous, wind shifted to SW. with lightning rapidity and barometer fell from 29.30 to 29.00; 31st, when 100 miles off Sable Island was struck by a most terrific SW. gale, sweeping decks of everything; 30th, in 40° N., 60° W., violent W. gale, lasting for twenty-four hours. Steamer *Blytheville*, 30th, off Sable Island, struck cyclone, wind seemed to come from all four points at once, sea running mountain high. In 41° N., 60° W., steamer *France*, 30th, experienced cyclone from SE. to W., with hurricane winds and high sea for thirty-six hours; in 43° N., 44° W., 30th, heavy SW. gale, suddenly shifting to NW. with terrific squalls. 31st, passed northward into Labrador, central area still inclosed by the isobar of 29.20; the barometer at Godthaab as the storm advanced reported a fall of 0.32 inch since the morning of the 30th. The further course of this area will probably appear on the chart for November, 1879. Of the storms over the Atlantic, the following descriptions are given: No. V.—Following the disappearance of area No. I, north of parallel 50° on the 7th, the pressure fell suddenly to the southward and by morning of the 8th a depression of considerable energy appeared in about 45° N., 50° W.; steamer *Hooper*, from Boston to London, experienced heavy gales from NNE.

veering to NE., E., SE. and S.; 9th, wind S. blowing very heavily, sea running mountain high; in 45° N., 45° W. heavy westerly gales lasting until the 12th. During the day depression moved slowly southwestward, while off Newfoundland heavy west and northwest gales prevailed continuing through the 10th. On the 9th, in 45°, 30′ N., 48°, 25′ W., 29.45, NE., force 6, heavy rain; winds on the eastern coast of Newfoundland shifted from NW. to N. and NE. and the pressure fell from 0.18 to 0.27 inch. 10th, pressure over Newfoundland rose from 0.05 to 0.10 inch, winds still NE. as the storm center passed to the southeastward; in 42°, 35′ N., 56°, 20′ W., 29.96, NE. force 6, rain; in 45°, 24′ N., 50°, 55′ W. very severe NE. gale; off Grand Banks, N. F., severe NNE. gale lasting 24 hours; off Banks of Newfoundland, steamer *Plantyn*, violent hurricane from E. veering to W. and lasting 24 hours; bark *Trenton* encountered fearful hurricane, seas mountain high. 11th, the following barometric readings show the extreme limit of the area of low to the east, west and south on this date; St. Johns, N. F., 29.84, NE., light rain; in 36° N., 50° W., 29.82, NW., force 6, rain; in 29° N., 38° W., 29.92, SW., force 6, rain; Angra, Azores, 29.86, S., fair. Reports from vessels at sea are given as follows: in 50°, 37′ N., 32°, 29′ W., SE. to S., strong gale, high confused sea; in 45°, 24′ N., 50°, 56′ W., NE., hard gale, high sea; in 43°, 51′ N., 48°, 15′ W., SE. to W., stormy, very high sea; in 44°, 13′ N., 50°, 04′ W. northerly gale; in 41°, 50′ N., 58°, 10′ W., schooner *Henry Lippett*, terrific gale from NE. changing to NW., lasting for five days, had to run S. to 33° N. before vessel was righted. 12th, in 35° N., 48° W., 29.63, NW., force 4; in 33° N., 37°, 40′ W., 29.80, S. force 6, rain; in 37°, 45′ N., 62° W., 29.92, force 6, cloudy; St. Johns, N. F., 29.74, NW., stormy; Angra, Azores, 30.06. SSW., fair; in 44°, 46′ N., 53°, 53′ W., N. hard gale, high sea; in 43° N., 53°, 42′ W., N. heavy storm; in 48°, 55′ N., 40°, 50′ W., SSE, squally, high sea; in 42°, 57′ N., 54°, 50′ W., fresh northeasterly gales. During the day this depression probably disappeared in an area of high pressure (30.40) central morning of the 13th northeast of the Azores. Following the disappearance of area No. V the pressure fell with considerable suddenness in the vicinity of 45° N., 50° W., the central area being inclosed within the isobar of 29.40 on the morning of the 13th. This area is not charted owing to the extreme irregularity of its course; so far as our charts would present reliable data the course of the area was circular, returning frequently upon itself, or perhaps more strictly, it was about stationary. This peculiar condition continued from the 13th to 20th, and was very likely due to the persistant constancy of an area of high pressure (30.40) which prevailed off the western coast of Europe and from which there was no relief until the morning of the 21st. 13th, in 36°, 35′ N., 37°, 38′ W., 29.86, SSW., force 6, heavy rain; in 34° N., 46° W., 29.77, NW., force 4, cloudy; in 37°, 40′ N., 60°, 15′ W., 29.87, N., force 6, cloudy; St. Johns, N. F., 29.47, W. fair; St. Pierre, N. F., 29.44, N.; in 43°, 02′ N., 59°, 59′ W., N. to NW., fresh gale, high sea; in 47°, 13′ N., 47°, 51′ W., SSE. to W., strong gale, squally, high sea. 14th, St. Johns, N. F., 29.46, SW. cloudy; St. Pierre, N. F., 29.35, W.; Sydney, C. B., 29.57, NW.; in 38° N., 57° W., 29.74, WNW., force 6, cloudy. 15th, St. John's, 29.64, S., fair; St. Pierre, 29.48, NW; Sydney, C. B., 29.73, N., cloudy; in 39°, 40′ N., 53°, 15′ W., 29.67, SW., force 6; in 37° N., 57° W., 29.90, NW., force 4, cloudy. 16th, St. John's, 29.82, NW., fair; St. Pierre, 29.47, NE.; in 40°, 15′ N., 50°, 10′ W., 29.68, W., rain; in 47°, 30′ N., 41°, 40′ W., 29.78, S., cloudy. 17th, depression apparently central in 45° N., 45° W; in 45°, 40′ N., 48°, 30′ W., 29.74, SW., cloudy; in 47°, 15′ N., 43°, 25′ W., 29.78, W., rain; in 42° N., 48°, 50′ W., 29.87, NW., cloudy. 18th, probably central near 40° N., 50° W.; in 46° N., 50° W., 29.90, S., cloudy; in 42° N., 49° W., 29.64, NNW., force 6, heavy rain; in 45°, 40′ N., 38°, 45′ W., 30.00, NNE., force 6, heavy rain; in 44° N., 55° W., 29.80, NW., threatening; in 41° N., 47° W., revolving storm, veering from ENE. by N. to SW., blowing with terrific violence, heavy rain, high cross-seas. 19th, probably central in 44° N., 45° W.; in 41°, 35′ N., 46°, 40′ W., 29.75, SSE., fair; during this and the following day combined with area No. IX, then moving southeastward from the Canadian Maritime Provinces. No. XIX.—On the 26th as area No. XVII appeared central in about 60° N., 40° W., a very narrow barometric trough of 29.90 extended south-southwest to about 35° N., 50° W. On either side of this contracted area of low, were situated two areas of extremely high pressure, 30.40 in 47° N., 30° W. and 30.80 over the Middle Atlantic states. On the 27th these two areas of high pressure were rapidly dissipated by the counteracting influence of no less than five seperate areas of barometric minima between the meridians of 10° and 90° W. and the parallels of 20° and 70° N. Their respective positions can be ascertained by referring to the charting of areas No. XVII, XIX, XX, XXI and XXIII. By the morning of the 27th an area of 29.60 appeared in about 40° N., 50° W.; in 43°, 30′ N., 46°, 25′ W., 29.59, ESE., force 4, rain; 28th, in 44°, 35′ N., 45° W., 29.50, N., fair; in 41°, 11′ N., 57°, 21′ W., steamship *Abana*, reported, noon, barometer 30.17, wind S., sea calm, clear during evening, at midnight 29.80 increasing southerly wind; 29th, 4 a. m,, heavy gales from E. and S., rain in torrents, barometer 29.00, ship unmanageable on account of wind; 7 a. m., wind backed to E.; 8.30 a. m., violent hurricane increasing in force, barometer gradually fell to 28.50; 9 a. m., barometer 28.00; 9.25 a. m., suddenly calm for 15 minutes, the stillness being very oppressive, wind previously from the east now began to blow from the west with increased violence, no object visible at more than 20 feet distant, ship unmanagable; 9.50 a. m., wind WSW., heavy gale, barometer rose 0.50 inch in 90 minutes, wind continued WSW. until 6 p. m., when it hauled round to W., barometer, 29.20; gales from W. and NW., continued to 7 a. m. of the 30th, after which the vessel passed into an area of

high pressure (30.20) with clearing weather but a continuance of northwesterly gales. The central area of barometric minima on this day (28th) extended from near 50° N., 50° W., west-southwest to the position of area No. XX, off the North Carolina coast. Although this elongated area of low pressure is not clearly delineated upon our daily charts, reports from the logs of vessels show the barometer to have reached a very low point and the winds to have been exceedingly severe. 29th, in 45° N., 41°, 30′ W., 29.61, W., force 7, rain; in 49°, 01′ N., 33°, 14′ W., NE. to SE., stormy, high seas; in 51°, 24′ N., 38°, 36′ W., SE., gale; in 47°, 45′ N., 42°, 34′ W., SE., moderate storm, rain, high sea. During the day depression lost its identity through the overwhelming influence of areas No. XXII and XXIII, central respectively over the Gulf of St. Lawrence and between the Azores and Maderia Islands. No. XXIII.—Resulting from the extensive area of barometric minima which on the 30th prevailed from Hudson's Bay southeastward to the northwestern coast of Africa, the isobar of 29.80 inclosed the central area. At Funchal the barometer in the past 24 hours fell 0.10 inch, and at Ponta Delgado 0.21 inch; on the western coast of Spain and Portugal there was a rise of 0.07 to 0.13 inch with winds shifting from NE. to S. and SE. 31st, central off the western coast of Spain and Portugal, winds backing to SE. and E. with rising pressure at land stations, rainy and threatening weather becoming general. Of the storms over the Atlantic, north of parallel 60° and over northern Europe, the following descriptions are given: No. II.—This storm is a continuation of area No. XXI of the September, 1879, chart. Central south of Iceland on the 1st, it moved northeastward north of the Faroe Islands during that day and the following, barometer at Stykkisholm, 29.27, wind N.; Thorshavn, 29.25, SSE., a fall of 0.58 inch in past 24 hours; Monach Light-house, 29 37, SW., a fall of 0.50 inch in past 24 hours; North Unst, 29.49, SSE., a fall of 0.55 inch. 2nd, Stykkisholm, 29.16, NW.; Thorshavn, 29.31, SSE.; Monach Light-house, 29.43, SW.; North Unst, 29.53, S. 3rd, Stykkisholm, 29.54, ENE.; Thorshavn, 29.23, WNW.; North Unst, 29.24, SSW.; pressure along the coast of Norway fell from 0.15 to 0.25 inch, with winds shifting to SW. and SE. During the day depression passed southeastward into southern Scandinavia, accompanied to the southward over Denmark and along the southern shores of the White Sea by northwesterly gales and light rains. 4th, pressure at centre generally below 29.60. 5th, central over the Gulf of Bothnia near 60° N., 20° E., with increased pressure, barometer at center below 29.80; rain prevailed at most Gulf stations with NE., S., SW. and NW. winds. 6th, central over Lapland, followed over the Gulf of Bothnia by rising pressure, northwesterly winds and clearing weather; Tromso, 29.62, SW., a fall of 0.18 inch in past 24 hours; Archangel, 29.81, S., a fall of 0.27 inch in past 24 hours. 7th, depression about stationary, disappearing by morning of the 8th north of the White Sea. No. VII.—Following the disappearance of area No. II, the pressure fell suddenly over northern Scandinavia and Lapland. 9th, Tromso, 29.59, SW. rain, a fall of 0.20 inch in the past 24 hours; Archangel, 29.72, SSW. rain, a fall of 0.22 inch in past 24 hours. 10th, central over the White Sea, with a barometric trough (29.60), extending south to parallel 50° N.; Archangel, 29.54, SSW. rain; Tromso, 29.73, calm, rain; St. Petersburg, 29.58, S. rain. 11th, central southeast of the Gulf of Finland; Moscow, 29.58, NNW.; St. Petersburg, 29.80, NE.; Dorpat, 29.87, NW.; Kieff, 29.63, ESE.; Lugan, 29.78, SW. rain. 12th, depression curved to the northeast with lowest pressure again at Archangel, 29.54, NW. a fall of 0.31 inch in past 24 hours; winds over central Russia shifted to S and SW. 13th, lowest pressure at Kasan 29.46, a fall of 0.20 inch in past 24 hours, wind SSE; Krotkowo, 29.47, S. a fall of 0.31 inch. During the day this area dissipated under the influence of No. X, central over the Gulf of Finland, and an area of high pressure (30.30) over western Siberia. The irregularity of the movement of this area (No. VII) since the 11th, was probably due to the constant high pressure over western Siberia. No. X,—On the morning of the 13th, there was an extremely sudden fall of the barometer in northern Scandinavia; Umea, 28.88, a fall of 1.00 inch in past 24 hours, wind SW.; Hernosand, 28.91, a fall of 1.02 inch, wind SW.; Haparanda, 29.06, a fall of 0.76 inch, wind, NE., light snow; Brono, 29.10, a fall of 0.80 inch, wind, NNW., 29 miles per hour. 14th, depression central near St. Petersburg, barometer 28.72, a fall of 0.86 inch in past 24 hours, wind WSW.; Dorpat, 29.02, NW; Archangel 29.26, ENE.; Moscow, 29.15, SE. 15th, depression about stationary with rapidly increasing pressure; St. Petersburg, 29.10, NW; Dorpat 29.26, WNW; Archangel 30.07, NE; Moscow, 29.35, S. By morning of the 16th, the depression had moved northeastward being central east of the White Sea; Archangel 29.27, NW.; Ekaterinburg, 29.30, a fall of 0.29 inch in past twenty-four hours, wind S. 17th, central in the valley of the Obi, followed by a rise of 0.46 inch at Ekaterinburg, wind shifting to W. 18th, central in the valley of the Yenisei, north of parallel 60° N; Yeniseisk, 29.77, a fall of 0.22 inch in past twenty-four hours, wind shifting from E. to S.; Barnaul, 29.97, a fall of 0.08 inch in past twenty-four hours, wind SW. During the day area disappeared to the eastward over northern Siberia. No. XII.—On the 16th, a small area of 29.60 appeared south of Iceland; Stykkisholm, 29.73, a fall of 0.44 inch in past twenty-four hours, wind shifted from SE. to NE., with rain; Thorshavn, 29.61, a fall of 0.78 inch in the past twenty-four hours, wind shifted from N. to S. 17th, depression passed rapidly northeastward to the Norway coast; Thorshavn, 28.81, N.; Brono, 29.13, a fall of 0.67 inch in past twenty-four hours, S., rain; Bergen, 29.37, a fall of 0.75 inch in past twenty-four hours, S., rain; Tromso, 29.35, a fall of 0.25 inch in past twenty-four hours, NE., cloudy; Christiania, 29.45, a fall of 0.69 inch in past twenty-four hours, SW., rain; the

winds over the British Isles shifted to N. and NW., with increased force and rapidly falling pressure, the latter, owing to the formation of a barometric trough extending from Lapland southwestward to the Bay of Biscay. 18th, with enlarged area the depression became central south of the Gulf of Finland; Dorpat, 29.35, a fall of 0.67 inch in past twenty-four hours, ENE., heavy snow; St. Petersburg, 29.47, a fall of 0.51 inch, E., snow; Wilna, 29.27, a fall of 0.70 inch, NW., threatening; Kieff, 29.47, a fall of 0.21 inch, WNW., light rain; Moscow, 29.39, a fall of 0.78 inch, SE., rain. 19th, on this date the isobar of 29.80 covered the whole of Europe north of the 50th parallel, area No. XIII being central southeast of Iceland and No. XII between the Gulf of Finland and the White Sea. Archangel, 29.21, a fall of 0.66 inch in past twenty-four hours, E., snow; St. Petersberg, 29.13, W., snow; Dorpat, 29.35, stationary, W., snow. During the day the depression disappeared east of the White Sea under the influence of a high area over western Siberia. No. XIII. On the 17th, the barometer at Stykkisholm rose 0.18 inch, wind veered from NE. to E. after the passage of area No. XII. At Godthaab, barometer rose slightly, wind veered from NE. to S. 18th, Stykkisholm, 28.83, a fall of 1.08 inches in past twenty-four hours, SE., force 8, rain; Godthaab, 29.61, a fall of 0.20 inch in past twenty-four hours, SW., cloudy; Thorshavn, 29.65, SSE, a fall of 0.17 inch. 19th, Stykkisholm, 28.87, WSW., rain; Godthaab, 29.42, N., cloudy; Thorshavn, 28.78, NW.; North Unst, 28.72, a fall of 1.04 inches in past 24 hours, W., force 6; Monach Light-house, 28.98, W., force 6, a fall of 0.78 inch. 20th, pressure below 29.80 over the whole of Europe north of the 45th parallel; area central over southern Scandinavia inclosed by the isobar of 28.80; Bergen, 28.72, NNW., a fall of 0.25 inch in past 24 hours; Brono, 29.01, E., a fall of 0.21 inch; Christiania, 28.76, S., a fall of 0.51 inch; Upsala, 28.76, SSW., a fall of 0.59 inch in past 24 hours; Vestervig, 28.81, a fall of 0.38 inch, W., rain; over Denmark the pressure was below 29.00, winds southwesterly. 21st, depression central over the Gulf of Bothnia, with considerably diminished pressure, the isobar of 29.20 inclosing the central area; lowest barometer at Wisby, 29.07, WNW; clearing weather, with SW. to NW. winds and rising pressure, prevailed over the British Isles and central Europe. 22nd, central over Finland; Archangel, 29.41, S.; St. Petersburg, 29.48, S.; Haparanda, 29.44, N.; Umea, 29.45, N.; Hernosand, 29.50, NW.; Dorpat, 29.53, S., rain. During the day disappeared east of the White Sea in a high pressure area over western Siberia. No. XIV.—Following the passage of No. XIII the barometer, at Stykkisholm on the 20th, rose 0.69 inch, winds shifting from W, to E., but by morning of the 21st there was a fall of 0.21 inch reported, wind S, rain. 22nd, depression central off the coast of Norway; Brono, 29.24, S., a fall of 0.17 inch in past 24 hours; Tromso, 29.34, SW.; Haparanda, 29.44, N.; on this day the centres of the two areas, Nos. XIII and XIV, were on nearly the same parallel and within 20° of longitude. 23rd, depression central over Finland; Umea, 29.13, N.; Haparanda, 29.26, N.; Hernosand, 29.25, WNW.; St. Petersburg, 29.31, SW.; Dorpat, 29.47, SW. 24th, central over the White Sea; Archangel, 29.34, W., a fall of 0.11 inch; during the day passed southeastward into northwestern Siberia. 25th, Ekaterinburg, 29.87, NW, a fall of 0.11 inch in past 24 hours; area passed slowly southeastward over the valley of the Obi and by morning of the 26th, Barnaul barometer read 29.82, or a fall of 0.33 inch, wind shifted from NW. to S.; Yeniseisk, 29.89, a fall of 0.46 inch, wind shifted to SE. 27th, Barnaul 29.65, NW., threatening; Yeniseisk, 29.78, S., rain. 28th, Barnaul, 30.24, SW., snow; Yeniseisk, 30.11, W., cloudy. No. XV.—On the 21st the barometer at Godthaab read 29.34, a fall of 0.14 inch in past 24 hours, wind veering to E., from N. on the 19th and NNE. on the 20th. 22nd, Godthaab, 29.25, wind backed to NW.; Stykkisholm, 29.74, E., force 8, a rise of 0.39 inch in past 24 hours. 23rd, Godthaab, 29.87, SW.; Stykkisholm, 29.25, SE., rain. During the day the depression moved rapidly eastward and by morning of the 24th was central north of the Shetland Isles. Thorshavn, 29.33 W.; North Unst, 29.42, NW.; Bergen, 29.47, S., rain; Brono, 29.56, calm; Tromso, 29.57, calm. 25th, central over the North Sea; winds over the British Isles from NE. to W.; over northern France, Germany and Denmark W. to SE., pressure generally below 29,80, central area below 29.60. During the day the depression probably disappeared over Germany through the influence of approaching high areas to the east and west, 30.60 north of the Azores and 30.20 over central Russia. Had our daily charts reported the distribution of atmospheric pressure for more than one hour of the day it is more than probable that area No. XVIII would prove to be but a continuation of No. XV. No. XVIII. The peculiar course of this probably separate area appeared to be due to the encroachment of high-pressure areas situated to the east and west. On the morning of the 26th the barometer fell very suddenly over the Bay of Biscay, followed by the appearance of an area of 29.60 off the northern coast of Spain; rain, with southerly winds, commenced at Spanish stations on the 26th, continuing throughout the remainder of the month. 26th, Santiago, 29.61, SE. rain, a fall of 0.40 inch in past 24 hours; Bilbao, 29.78, S., cloudy, a fall of 0.24 inch in past 24 hours; along the coast of France there was a fall of 0.05 to 0.08 inch, winds shifting from W. to SE. and E.; Lisbon, 29.85, SW., a fall of 0.13 inch in past 24 hours. 27th, Santiago, 29.69, SSE.; Lisbon, 29.67, S., rain; Campo Major, 29.82, SE., rain. During the day the high areas previously spoken of as situated to the east and west combined to the northward over Europe between the parallels of 50° and 60° N., forming an area of 30.40. Throughout the 28th and 29th the depression remained about stationary over Portugal and western Spain, accompanied by southerly winds and rain; by

morning of the 30th had disappeared to the eastward in an area of high pressure, 30.20, followed to the westward by slowly rising pressure and southeasterly winds, the latter owing to the advance of area No. XXIII from the southwest. Of the storms over southern Europe the following descriptions are given: No. VI.—While area No. II appeared central near the White Sea on the 7th, the pressure fell considerably over that portion of Russia just north of the Black Sea, forming by morning of the 8th an area of 29.80; Kieff, 29.71, WNW., a fall of 0.24 inch in past 24 hours; Nikolaeiv, 29.85, W., a fall of 0.23 inch; Lugan, 29.79, calm, a fall of 0.21 inch. 9th, depression about stationary; Kieff, 29.82, NE; Nikolaiev, 29.89, S.; Lugan, 29.81, NE. 10th, Kieff, 29.77, NW.; Nikolaiev, 29.84, NNW.; Lugan, 29.68, E. During the day area No. VII, then central over the White Sea, formed a barometric trough of 29.60, which extended southward to parallel 50° N., with which, by morning of the 11th, area No. VI combined; lowest barometer at Moscow, 29.58, NW., a fall of 0.20 inch in past 24 hours. No. XI.—During the 14th there was a fall in pressure of from 0.25 to 0.35 inch over Switzerland and northern Italy, winds S. and SW, accompanied by light to heavy rains, pressure generally below 29.80. By morning of the 16th a decided depression had formed over the central portion of Italy inclosed within the isobar of 29.60; Leghorn, 29.38, W., a fall of 0.48 inch in past 24 hours; Pesaro, 29.39, SW., a fall of 0.41 inch; Genoa, 29.41, N., a fall of 0.37 inch; Florence, 29.42, W., a fall of 0.42 inch. 17th, with rising pressure, clearing weather and northerly winds the central area passed eastward into northern Turkey; Hermannstadt, 29.42, NW., rain, a fall of 0.32 inch in past 24 hours; Consfantinople, 29.63, SSW., a fall of 0.39 inch; Valona, 29.83, S. cloudy, 1.85 inches rain-fall in past 24 hours. 18th, depression central in eastern Austria; Lemberg, 29.59, NW., hailstorm, 2.01 inches rain-fall in past 24 hours; Hermannstadt, 29.85, WNW.; Szathmar, 29.80, SW.; Szegedin, 29.80, W. During the day this depression lost its identity over western Russia through the influence of area No. XII then passing to the eastward near the Gulf of Finland, but on that day the isobar of 29.60 extended southward to the Black Sea and covered nearly the whole of central Europe. No. XVI.—The powerfully disturbing effects of area No. XIII, particularly on the 20th and 21st, causing the lowest barometric readings of the month over Europe, appeared to be instrumental in the formation of another depression over Italy. On the morning of the 21st the barometer indicated a fall of from 0.25 to 0.50 inch in past 24 hours at northern stations, the central area being inclosed by the isobar of 29.60; lowest barometer, 29.51 at Leghorn; rainfall quite general. 22d, with increased pressure, the central area (29.80) covered the southern half of the kingdom; winds variable, lowest barometer 29.58 at Cosenza, 1.07 inches rainfall in past 24 hours. 23d, central in the valley of the Danube, accompanied by quite general rains, with northwesterly winds over Austria and southeasterly winds over Turkey. Over Italy northerly winds and clearing weather prevailed. By morning of the 24th depression had disappeared to the eastward in an area of high pressure, 30.20, prevailing in the vicinity of the Caspian Sea. No storms have been charted on the Asiatic coast, although this month is one (last one) of the four comprising the typhoon season of the China and Japan seas. There are some reports from the logs of vessels which indicate the presence of these storms, but the data is irregular and the stations on the Asiatic coast are so few from which reports are regularly received, that it is not deemed advisable to attempt the indication of storm tracks on the chart, and the following disconnected data is furnished, principally from the reports of vessels: Steamship *Gaelic*, Hong Kong, 8th, 29.59, NE., force 8 to 9; 9th, 29.80, NNE., force 2; 10th, 29.91, NE., force 5, heavy squalls at intervals. Hong Kong, 9th, typhoon a little to the south; at 4.30 p. m., 29.32, typhoon probably moved from SE. to NW. Manilla, 7th, 29.70, WSW; 8th, 29.79, S. Zi-Ka-Wei, 24th, between 4.45 and 5.00 a. m., typhoon passed over station, wind shifted from ESE. to WNW., lowest barometer 29.76. Macao, 26th, 29.97 a fall of 0.11 inch in past twenty-four hours, wind shifted from SE. to S. Hong Kong, 25th, heavy NE. gale. Manilla, 26th, 29.81, NE. Steamship *Gaelic*, 23d, in 25°, 18′ N., 119°, 59′ E., 30.10, N., force 5, rough sea, threatening; 24th, in 27°, 04′ N., 124°, 01′ E., 29.90, SSE., force 4, moderate sea, threatening; 25th, in 28°, 56′ N., 128°, 31′ E., 29.82, W., force 5, rough sea, rain; 26th, in 30°, 29′ N., 133°, 11′ E., 30.00, NW., force 5, rough sea, squally. Nagasaki, 26th, 29.66, a fall of 0.45 inch in past twenty-four hours, wind shifted from N. to W., rainfall 1.86 inches; 27th, 30.00, NW., cloudy. Hiroshima, 26th, 29.80, a fall of 0.35 inch in past twenty-four hours, wind shifted from ENE. to NNE, rainfall 1.30 inches; 27th, 29.91, NNW., clear. Tokei, 26th, 30.10 a rise of 0.07 inch in past twenty-four hours, wind shifted from NNW. to N., rainfall 1.58 inches; 27th, 29.64, N., rainfall 1.08 inches. Waykayama, 26th, 29.91, a fall of 0.22 inch in past twenty-four hours, wind shifted from NE. to ENE., rainfall 5.59 inches; 27th, 29.83, N., cloudy. On the 28th a pressure of from 30.03 to 30.17 covered the Japan Islands, winds shifting to SW. and NW. with clearing weather. It seems very probable from a study of the daily charts since the 24th, notwithstanding the scarcity of data, that a typhoon appeared on that date over the China Sea, south of Hong Kong, pursuing thereafter a northeasterly course, hugging the coast closely, perhaps crossing the Island of Formosa, and after reaching the latitude of the Lew Chew Islands curved more to the east, then again to the northeast, passing off the Bay of Yeddo on the 27th. It will be seen from the following record of maximum readings for the month over

the Japan Islands and along the Asiatic coast from 25° to 50° N., that few typhoons could have pursued their customary paths between these parallels: 1st, 30.27; 2d, 30.29; 3d, 30.33; 4th, 30.52; 5th, 30.34 :6th, 30.25; 7th, 30.25; 8th, 30.29; 9th, 30.44; 10th, 30.39; 11th, 30.24; 12th, 30.20; 13th, 30.24; 14th, 30.27; 15th, 30.34; 16th, 30.33; 17th, 30.33; 18th, 30.26; 19th, 30.22; 20th, 30.26; 21st, 30.21; 22d, 30.27; 23d, 30.21; 24th, 30.22; 25th, 30.15; 26th, 30.10; 27th, 30.22; 28th, 30.32; 29th, 30.32; 30th, 30.32; 31st, 30.28. Over the China Sea and Phillipine Islands, the developement and passage of typhoons may have occurred with the usual frequency, but little can now be said regarding that probability, owing to the extreme paucity of reports from these localities.

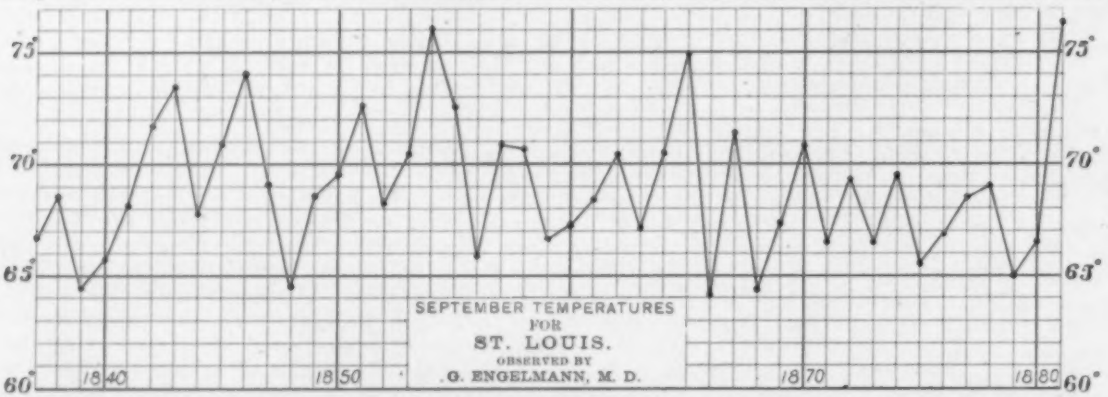
TEMPERATURE OF THE AIR.

The mean temperature of the air for September, 1881, is shown by the isothermal lines (in red) on Chart No. II. The table of mean and comparative temperatures in the right-hand corner of the chart shows, in the first column, the average for the month throughout the various districts, as deduced principally from observations taken at Signal Service stations. In the two remaining columns are shown the means for the present month and the departures of such means from the average for many years. South and east of a line extending southwestward from Lake Michigan to New Mexico, the temperature is everywhere above the normal. The excess ranges from about normal in the Florida peninsula and Rio Grande valley to 8°.9 in the Lower Lake region. There is a slight excess reported from the Southern Pacific Coast region. The mean temperature of the present month is remarkably high over the eastern portion of the country. In comparison with previous years the departures from normal are found to be the largest by from 2° to 3°, that have occurred since the establishment of Signal Service stations. The region of greatest excess (from +°5.7 to +8°.9) is embraced by the following districts: Upper Mississippi valley, Ohio valley and Tennessee, Middle Atlantic states and the Lower Lake region. Since 1872, the following are the maximum departures of excess, with corresponding districts: 1873, +0°.6, West Gulf states; 1874, +5°.8 and +4°.7, Upper and Lower Lakes, respectively; 1875, all deficiencies; 1876, all deficiencies; 1877, +5°.9 and +4°.6, in the Upper Missouri and Upper Mississippi valleys, respectively; 1878, +3°.6, Upper Lakes; 1879, +5°.8, Western Plateau; 1880, +1°.8 and +1°.9, in New England and the Northern Plateau, respectively. Throughout the Plateau and in the Middle and Northern Pacific Coast regions, in Minnesota and the Missouri valley, the temperature is below the average, the deficiency ranging from —0°.8 in Minnesota to —5°.1 in the Northern Plateau.

Ranges of Temperature at Signal Service stations.—Monthly ranges in general varied from 25° to 49° over the country east of the Rocky Mountains and from 45° to 60° to the westward of that region. The *smallest* ranges were: Punta Rassa, 20°; Key West, 21°; Portsmouth, N. C., 22°; Hatteras and Fort Macon, 23°; Port Eads, 24°; Charleston, Savannah, Galveston and Jacksonville, 25°; Cedar Keys, Charlotte, Smithville and Wood's Holl, 26°; Chincoteague, 27°; Cape Henry and Norfolk, 28°. The *largest* were: Ft. Gibson, 73°; North Platte, 72°; Eagle Rock, 69°; Winnemucca, 68°; Fort Bennett and Campo, 65°; Yankton, 64°. The *daily* ranges varied in the different districts as follows: New England, 15° at New Shoreham to 33° at Thatcher's Island; Middle Atlantic states, 19° at Atlantic City to 35° at Sandy Hook and Washington; South Atlantic states, 15° at Charleston and Portsmouth to 24° at Augusta; Florida Peninsula, 17° at Key West to 19° at Cedar Keys; Eastern Gulf states, 20° at Pensacola to 29° at Vicksburg; Western Gulf States, 13° at Port Eads and 16° at Galveston to 38° at Shreveport and 47° at Fort Gibson; Ohio valley and Tennessee, 22° at Cincinnati to 32° at Knoxville and Champaign; Lower Lake region, 24° at Toledo to 31° at Buffalo; Upper Lake region, 25° at Grand Haven and Escanaba to 32° at Chicago; Upper Mississippi valley, 27° at Cairo to 35° at Dubuque and 44° at St. Paul; Missouri valley, 32° at Leavenworth to 42° at Fort Bennett; extreme Northwest, 34° at Moorehead to 45° at Fort Buford; Northern Slope, 40° at Cheyenne to 50° at Fort Keogh and North Platte; Middle Slope, 47° at Fort Elliott to 41° at Denver and 45° at Dodge City; Southern Slope, 24° at Henrietta to 39° at Concho and 44° at El Paso; Rio Grande valley, 27° at Brownsville to 36° at Rio Grande and 38° at Castroville; Northern Plateau, 40° Lewiston to 47° at Missoula; Middle Plateau, 32° at Salt Lake City, 35° at Pioche and 57° at Winnemucca; Southern Plateau, 25° at Fort Grant to 45° at Prescott and 46° at La Mesilla; North Pacific coast, 35° at Olympia to 44° at Roseburg; Middle Pacific coast, 22° at San Francisco to 38° at Sacramento; Southern Pacific coast, 23° at San Diego to 45° at Los Angeles and 55° at Campo.

Deviations from Mean Temperatures.—Under this heading departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on the right-hand side of chart No. II. The following items of importance in connection with this subject are reported by voluntary observers: *Connecticut:* Southington, month marked by extreme heat; mean temperature far above the average; higher than the mean of August for the past six years, and the mean of June for the past twelve years, being nearly equal to the mean of the warm July of 1875. *Illinois:* Rockford, mean temperature considerably above the average. *Iowa:* Clinton, mean temperature 7°.8 above the mean for 1880 and 9°.9 above the mean for 1879; first September for many years without frost. *Kansas:* Lawrence, mean temperature 4°.8 above

the mean for the past 13 years. *Maine:* Gardiner, mean temperature 3° above that of past 45 years; but three instances during that period where the monthly means exceeded that of the present month; in 1841 mean temperature 3°.05 above the mean of the present month. *Maryland:* Fallston, mean temperature 9°.7 above mean of past 10 years; Sandy Springs, mean temperature 7° above that of the past 15 years; warmer than any August for past 10 years and warmer than any June for past 15 years. *Missouri:* St. Louis, the "Missouri Weather Service" reports: mean temperature considerably above the average of the past 45 years; highest mean during that period,



76°.0 in 1854; highest maximum 102°.5 in September, 1864; lowest minimum, 35° in September, 1839. *Nebraska:* Nebraska Weather Service reports: mean temperature of the State 4° above September, 1880. *New Hampshire:* Contoocookville, mean temperature 5°.2 above the average for the past 11 years. *New York:* Waterburg, mean temperature unprecedented as compared with the average of the past 10 years; warmest September during that period occurred in 1878, which was 9°.4 below that of the present year; the highest mean temperature recorded for any month during the past 10 years occurred in July, 1878 and is only 0°.8 above that for September, 1881. North Volney, mean temperature 8°.9 above that for the past 13 years; highest mean for any September during that period was 64°.2 in 1869, which mean is 5° below that of September, 1881. *Pennsylvania:* Dyberry, mean temperature 6°.5 above that of past 20 years. West Chester, mean temperature considerably above the average for the past 26 years. *Texas:* Clarksville, mean temperature 5° above the mean for the past 12 years. *Vermont:* Woodstock, mean temperature 6°.5 above the mean for the past 10 years; 13°.5 above the mean of September, 1871 and considerably warmer than any September for the past 14 years; warmest September during that period occured in 1880, mean 59°.63; coldest in 1871, mean 49°. *Virginia:* Johnsontown, warmest September in past 13 years; highest mean temperature (74°.6) during that period occurred in 1878, which is 5°.2 below the mean of the present month. *West Virginia:* Flemington, mean temperature remarkably high; month unusually hot. Helvetia, mean temperature 7°.9 above that of past five years.

High Temperatures.—The maximum temperatures of the month have in many instances been very remarkable, yet the suffering to animal and vegetable life did not assume the proportions of either of the two previous months. The regions within which the extremes of heat occurred coincided, as in July and August, with that section of the country reporting the greatest departure of the monthly mean from the average for many years. Compared with August there has been a very decided translation eastward of the area of excessive heat, and a remarkable increase of relative departures from the normal. The maximum temperatures occurring as they did between the 4th and the 10th, became associated with the passage of low areas No. I and II, whose extreme northerly courses were conducive to the accompanying movement of continued southerly winds over the central and eastern portions of the country. Dubuque, 5th, one case of sunstroke, first reported this year. Chicago, 6th, 94°, highest since 1873. Cincinnati, during the week ending the 10th three fatal cases of sunstroke occurred. Baltimore, 6th, several cases of sunstroke; 7th, 101°, highest ever recorded. Philadelphia, 7th, 101°.5, highest for the past 10 years. Ft. Myer, Va., 7th, 102°, highest ever recorded. Freehold, N. J., 7th, 100°, hottest since 1873; work suspended in the mills and at the iron foundry. New York City, 27th, 102° in the shade; two sunstrokes, none fatal. Southington, Conn., 7th, 100°, highest ever experienced. Charleston, Ill., 5th, 102°, highest for many years; extreme suffering from heat. Upper Alton, Ill., 5th, 101°. Anna, Ill., 5th, 102°. Laconia, Ind., 5th, 101°. Vevay, Ind., 5th, 100°. Forsyth, Ga., 4th, 100°. Rockford, Ill., 5th, mean temperature, 83°.5, highest daily mean reported during summer. Muscatine, Ia., 5th, 103°. Clay Centre, Kan., 3d, 109°. Independence, Kan., 3d, 105°. Lawrence, Kan., daily maximum temperature exceeded 90° on 14 days. Fallston, Md., 7th, 102°.5 higher than the highest maximum ever before recorded. Sandy Springs, Md., 7th, 98°.7 higher than the maximum temperature for any September during the past 15 years, and 3° above the highest maximum for the year 1881.

Woodstock, Md., 6th, 98°, highest maximum for September during the past 16 years. Dyberry, Pa., 7th, 95°, 8 higher than the highest maximum recorded during September for the past 20 years. Woodstock, Vt., 7th, 93°; 0°.4 above the highest maximum of any September during the past 10 years.

Low Temperatures.—Fort Supply, Ind. Ty., 7th, 275 head of cattle and three horses reported frozen to death at Beaver creek, 12 miles west of station; confirmatory report from Castroville, Tex., 10th, stated that a large number of cattle were chilled to death near Ft. Supply, from an extremely sudden fall in the temperature.

Table of Comparative Maximum Temperatures for the month of September.

State or Territory.	Maximum for September, 1881, Signal Service.		Highest since Signal Service Stations were opened—3 to 10 years.			Highest from any other source.			
	Station.	Temp.	Station.	Year.	Temp.	Place.	Year.	Temp.	Length of Record.
Alabama	Montgomery and Mobile	96°	Montgomery	1875	97°	Mount Vernon Arsenal	1860	98°	31 years.
Arizona	Yuma	107°	Burke's and Yuma	1879	113°	Fort McDowell	1879	114°	14 "
Arkansas	Little Rock	97°	Little Rock	1880	90°	Fort Smith	1860	101°	21 "
						Little Rock	1840	88°	37 "
California	Los Angeles	102°	Red Bluff	1877	106°	Fort Miller	1853	114°	13 "
Colorado	Denver	88°	Denver	1878	93°	Fort Lyon	1868	99°	19 "
Connecticut	New Haven	100°	New London	1880	89°	Columbia	1866	94°	9 "
						Fort Trumbull	1872	90°	47 "
						New Haven	1864	92°	87 "
Dakota	Yankton	100°	Fort Sully	1874	107°	Fort Randall	1863	107°	20 "
						Fort Sully	1874	106°	14 "
Delaware	Delaware Breakwater	93°				Fort Delaware	1865	90°	44 "
Dist. of Columbia	Washington	104°	Washington	1880	94°	Washington	1838	95°	58 "
Florida	Jacksonville & Key West	94°	Jacksonville	1875	98°	Fort Jefferson	1871	101°	12 "
						Fort King	1833	100°	10 "
Georgia	Augusta	97°	Augusta	1875	97°	Oglethorpe Barracks	1845	99°	36 "
Idaho	Fort Lapwai	90°	Boise City	1878	98°	Fort Boise	1874	103°	16 "
Illinois	Cairo	97°	Cairo	'75, '76	92°	Manchester	1864	102°	16 "
						Highland	'41, '43	100°	11 "
Indiana	Indianapolis	95°	Indianapolis	'74, '75	90°	Vevay	'65, '66	99°	15 "
Indian Territory	Fort Gibson	105°	Fort Gibson	'74, '80	98°	Fort Gibson	1834	103°	52 "
			Fort Sill	1877	98°	Fort Sill	1871	103°	10 "
Iowa	Keokuk	97°	Dubuque	1878	92°	Mount Vernon	1874	99°	16 "
Kansas	Dodge City	94°	Dodge City	1876	99°	Fort Leavenworth	1860	108°	49 "
Kentucky	Louisville	93°	Louisville	1875	93°	Newport Barracks	1864?	98°	28 "
Louisiana	Shreveport	101°	Shreveport	1877	98°	Fort Jesup	1824	100°	22 "
Maine	Portland	85°	Eastport	1877	81°	Brunswick	1825	96°	52 "
Maryland	Baltimore	101°	Baltimore	1875	92°	Fort Washington	1851	99°	37 "
Massachusetts	Boston	102°	Boston	1880	93°	Fort Warren	1872	100°	18 "
Michigan	Port Huron	97°	Detroit and Marquette	1874	97°	Fort Brady	1861	98°	57 "
Minnesota	St. Paul	91°	St. Paul	1878	94°	Fort Snelling	'34, '77-8	92°	60 "
Mississippi	Vicksburg	98°	Vicksburg	1878	100°	Columbus	1865	95°	9 "
Missouri	St. Louis	102°	St. Louis	1875	92°	Allentown	1868	100°	3 "
						Jefferson Barracks	1804	99°	35 "
Montana	Fort Benton	98°	Fort Keogh	1879	96°	Tongue River	1877	103°	3 "
						Fort Benton	1878	101°	11 "
Nebraska	North Platte	101°	North Platte	1878	97°	Fort McPherson	1870	102°	14 "
Nevada	Winnemucca	90°	Winnemucca	'78, '80	94°	Fort McDermitt	'75, '79	96°	15 "
New Hampshire	Mount Washington	64°	Mount Washington	1880	63°	Dartmouth College	'43, '45	92°	17 "
New Jersey	Sandy Hook	101°	Atlantic City	1880	94°	Haddonfield	1806	90°	6 "
New Mexico	La Mesilla	99°	La Mesilla	1879	105°	Fort Craig	'37–'71	103°	26 "
New York	New York City	100°	New York City	1875	94°	Poughkeepsie	1849	100°	20 "
North Carolina	Charlotte and Kittyhawk	92°	Kittyhawk	1880	95°	Fort Johnson	1831	98°	54 "
			Wilmington	'75, '76	95°				
Ohio	Cleveland and Columbus	98°	Cincinnati	1874	92°	Cincinnati	1868	100°	35 "
Oregon	Umatilla	91°	Umatilla	'77, '79	95°	Fort Haskins	1860	98°	9 "
Pennsylvania	Philadelphia and Pittsburg	102°	Pittsburg	1874	97°	Carlisle Barracks	1868	97°	54 "
Rhode Island	Newport	88°	Newport	1880	87°	Providence	1826	99°	35 "
South Carolina	Charleston	93°	Charleston	1876	94°	Fort Moultrie	1851	93°	27 "
Tennessee	Memphis and Nashville	98°	Memphis and Nashville	1875	93°	Humboldt	'71, '74	97°	4 "
Texas	Eagle Pass	104°	Rio Grande	1877	107°	Fort Stockton	1873	109°	21 "
Utah	Salt Lake City	87°	Salt Lake City	1875	93°	Fort Douglas	1876	97°	18 "
Vermont	Burlington	90°	Burlington	1880	90°	Lunenburg	1864	90°	8 "
Virginia	Fort Myer	102°	Norfolk	1880	96°	Fort Monroe	1863	97°	54 "
Washington T'y	Dayton	91°	Dayton	1880	88°	Fort Walla Walla	1860	98°	10 "
West Virginia	Morgantown	91°	Morgantown	1874	90°	Weston	1876	88°	4 "
Wisconsin	Madison and Milwaukee	92°	Milwaukee	1874	94°	Fort Howard	'26–'30	98°	30 "
Wyoming	Cheyenne	86°	Cheyenne	1875	88°	Fort Laramie	1871	99°	20 "

Frost.—In the various States and Territories it was reported, as follows: Arizona, 24th, 29th; Arkansas, 16th; California, Campo, 1st to 24th, 27th, 29th, 30th; Colorado, 10th; Dakota, 6th, 7th, 8th, 14th to 17th, 21st, 22d, 26th, 28th; Idaho, 2d, 6th to 16th, 19th to 22d, 24th, 26th, 27th, 29th, 30th; Illinois, 10th, 13th; Iowa, 10th, 12th, 28th; Kansas, 16th, 17th; Maine, 7th, 21st, 22d; Massachusetts, 2d, 28th; Michigan, 14th, 28th, 29th; Minnesota, 6th, 7th, 15th, 22d, 26th, 28th, 30th; Missouri, 11th, 16th; Montana, 1st, 2d, 5th, 7th, 9th to 17th, 21st, 25th to 29th; Nebraska, 16th, 28th; New Hampshire, 13th, 28th; New York, 12th, 14th, 29th; Nevada, 4th, 6th, 7th, 19th, 24th, 27th, 29th, 30th; Ohio, 12th; Oregon, 10th, 27th, 30th; Pennsylvania, 12th, 14th; Tennessee, 18th; Texas, 7th, 17th; Utah, 6th to 10th, 25th to 27th, 30th; Vermont, 21st, 22nd, 29th; Washington Territory, 2nd, 6th, 9th, 26th, 30th; Wisconsin, 28th, 29th; Wyoming, 10th, 15th to 17th, 30th.

Table of Maximum and Minimum Temperatures for September, 1881.

State or Territory.	Signal Service. Station.	Max.	Min.	U. S. Army Post Surgeons or Voluntary Observers. Station.	Max.	Min.	State or Territory.	Signal Service. Station.	Max.	Min.	U. S. Army Post Surgeons or Voluntary Observers. Station.	Max.	Min.
Alabama	Montgomery	96°	57°	Green Springs	98°	56°	Missouri	St. Louis	102°	49°	Pierce City		34°
Do	Mobile	96°					Montana	Ft. Benton	93°				
Arizona	Yuma	107°		Texas Hill	118°		Do	Ft. Missoula		23°			
Do	Prescott		34°				Nebraska	North Platte	101°	30°	Clear Creek & Genoa	103°	
Arkansas	Little Rock	97°	47°	Mt. Ida	98°	34°	Do				Hot Springs	98°	
California	Los Angeles	102°		Colton	112°		Nevada	Winnemucca	90°	22°	Auburn and		
Do	Campo		33°	Boca		34°	New Hampshire	Mt. Wash'ton	64°	28°	Contoocookville	95°	
Colorado	Denver	88°	37°				Do				Atco and		
Do				Ft. Lewis		28°	New Jersey	Sandy Hook	101°		Vineland	104°	
Connecticut	New Haven	100°	47°				Do	Atlantic City &			Freehold		46°
Dakota	Yankton	100°		Ft. Randall	102°		Do	Cape May		53°	Fort Union		23°
Do	Ft. Sully		21°				New Mexico	La Messilla	99°	43°	Pen Yan	102°	
Delaware	Breakwater	93°	63°				New York	N. York City	100°		Madison Barracks		39°
Dist. Columbia	Washington	104°	60°				Do	Buffalo		45°	Weldon	97°	
Florida	Cedar Keys			Ft. Brooke Tampa	98°		North Carolina	Charlotte and			Franklin and		
Do	Jacksonville			Ft. Barrancas		55°	Do	Kittyhawk	92°		Murphy		55°
Do	& Key West	94°					Do	Smithville		60°	College Hill	102°	
Do	Pensacola		62°				Ohio	Cleveland and			Westerville		43°
Georgia	Augusta	97°		Forsyth	100°		Do	Columbus	98°	50°			
Do	Atlanta		60°	McPherson Barracks		78°	Oregon	Umatilla	91°	33°			
Idaho	Ft. Lapwai	90°					Do	Roseburg		35°			
Do	Eagle Rock		17°				Pennsylvania	Philadelphia	102°		Milton	105°	
Illinois	Cairo	97		Anna and			Do	Pittsburg	102°	51°	Franklin		38°
Do	Springfield		47°	Charleston	102°		Rhode Island	Newport	88°	51°	Fort Adams	96°	
Do				Riley		42°	South Carolina	Charleston	93°	68°	Aiken	95°	65°
Indiana	Indianapolis	95°	48°	Laconia	101°		Do				Columbia	95°	
Do				Logansport		44°	Tennessee	Memphis	98°		Ashwood	100°	
Indian Ty	Fort Gibson	105°	32°				Do	Nashville	98°	50°			
Iowa	Keokuk	97°		Muscatine	103°		Texas	Eagle Pass	104°				
Do	Des Moines		40	Nora Springs		37°	Do	Grierson Springs		42°			
Kansas	Dodge City	99°	39°	Clay Center	109°		Utah	Salt Lake City	87°	39°	Ft. Douglass		34°
Do				Ft. Wallace		29°	Vermont	Burlington	90°	41°	Charlotte	92°	
Kentucky	Louisville	96°	54°				Do				Lunenburg &		
Louisiana	Shreveport	101°	47°				Do				Windsor		39°
Maine	Portland	93°		Orono		33°	Virginia	Fort Myer	102°	58°	Accotink	104°	
Do	Eastport		41°				Do				Snowville &		
Maryland	Baltimore	101°	59°	Fallston	102°		Do				Wytheville		48°
Do				Cumberland		54°	Washington Ty	Dayton	91°				
Massachusetts	Boston	103°		Williamstown		43°	Do	Colfax		27°			
Do	Springfield		46°				West Virginia	Morgantown	91°	50°	Fleming:on	99°	44°
Michigan	Port Huron	97°		Thornville	100°		Do				Helvetia		44°
Do	Marquette		42°	Ft. Brady		40°	Wisconsin	Madison and			Edgerton	98°	
Minnesota	St. Paul	91°					Do	Milwaukee	92°	46°	Neillsville		34°
Do	St. Vincent		24°				Do	LaCrosse		46°			
Mississippi	Vicksburg	98°	51°	Fayette		48°	Wyoming	Cheyenne	86°	32°	Ft. Bridger		15°

Ice.—Ft. Gibson, 16th, formed in exposed places. Clay Centre, Kan., 17th. Cheyenne, 15th, $\frac{1}{16}$ inch. Eagle Rock, 15th, $\frac{1}{8}$ inch; 21st, $\frac{1}{4}$ inch; 28th, very thin. Boise City, 26th. Winnemucca, 11th, 19th.

PRECIPITATION.

The general distribution of rain-fall for the month of September, 1881, is shown on chart No. III, from the reports of over 500 stations, From the table in the left-hand corner of the chart is obtained a monthly average for each of the various districts, determined from the records (covering a period of many years) of Signal Service stations, and also a comparison of the present month with such averages. Upon examinination of the chart it is found that the monthly rain-fall is decidedly above the average throughout the central portions of the country, the regions of excess being most marked in the Upper Mississippi and Missouri valleys. With the exception of Minnesota these were the regions of considerable deficiency in August. Minnesota reports the largest excess (4.44 inches) that has occurred in that state since the establishment of Signal Service stations, and with the exception of an excess of 5.50 inches in the West Gulf States in 1875, is the largest ever reported by any district. The marked excess of 3.59 inches in the Upper Mississippi valley is by far the largest ever reported by that district, the next highest 2.35 inches occurred in September, 1876. With regard to the Missouri valley the excess there reported 3.03 is the largest since 1872, the next highest 2.10 inches occurred in 1876. Throughout the Atlantic coast states and reaching northwestward to include the Ohio valley and the Lower Lake region deficiencies ranging from 0.43 inch to 2.61 inches occur. A slight deficiency is reported from the North Pacific coast region while the South Pacific coast is normal. In the Plateau and Rocky Mountain regions the extremes are from 0.00 in Nevada to 3.80 in southeastern Arizona and southwestern New Mexico.

Deviation from Average Precipitation.—Under this heading departures exhibited by the reports from the regular Signal Service stations are shown in the table of comparative temperatures on the left-hand side of Chart No. III. The following items of importance in connection with this subject were reported by voluntary observers:—*Connecticut:* Southington, monthly rain-fall less than for any month since 1869. *Kansas:* Lawrence, monthly rain fall nearly double the average

of the past 13 years; during this period it has been exceeded but once, viz: in September, 1874. Yates Center, monthly rain-fall, 7.80 inches above that of September, 1880; largest precipitation for several years. *Iowa:* Nora Springs, monthly rain-fall exceedingly large, being nearly four times the average of the past 6 years. *Maine:* Gardiner, monthly rain-fall 0.23 inch below the average of the past 45 years. *Maryland:* Fallston, monthly rain-fall considerably below the average; month unusually dry. Sandy Springs, month extremely dry; monthly rain-fall below the average of the past 15 years. *Massachusetts:* Springfield, there has been but three Septembers during the past 33 years in which the monthly rain-fall was below that of September, 1881, viz: in 1855, 0.74 inch; 1865, 0.65 inch; 1877, 0.78 inch. *Missouri:* St. Louis, the Missouri Weather Service reports: monthly rain-fall 0.15 inch below the mean of the past 45 years; heaviest precipitation, 10.53 inches, fell in September, 1866. *New Jersey:* Atco, monthly rain-fall considerably below the average; month exceedingly dry. *Nebraska:* Nebraska Weather Service reports: average for the entire State, 4.14 inches, against 3.35 inches in 1880, and 2.20 inches in 1879; the average for September, 1881, has been exceeded but five times in the past 30 years; the monthly rain-fall at Howard, (12.96 inches) during the present month is the largest ever recorded in September, in this State. *New York:* North Volney, monthly rain-fall 1.68 inches below the average of the past 9 years; during that period the largest precipitation (4.65 inches) occurred in 1870, and the smallest, 1.70 inches, was recorded in 1880.

Special Heavy Rains.—1st, Leavenworth, 2.60 inches. 2nd, Toledo, 1.82 in 1 hour and 10 minutes. 4th, Moorehead, Minn., 2.57. 5th, Fort Union, N. M., 2.44; Fort Fetterman, Wyo., 2.60. 5th and 6th, Fort Wallace, Kan., 2.50. 6th, Yankton, 3.45; Smithville, Dak., 4.08. 6th and 7th, Fort Supply, Ind. Ty., 3.18. 9th, Smithville, N. C., 2.41. 9th and 10th, Neillsville, Wis., 4.30; Genoa, Nebr., 2.70 in 10 hours and 30 minutes. 11th, San Antonio, 3.09; Eagle Pass, 2.87. 13th, Charleston, 2.46; Decatur, 2.27; Fort Griffin, Tex., 2.76. 13th and 14th, Ashwood, Tenn., 3.90. 14th, Fort Macon, N. C., 2.68; Shreveport. 4.06; Ellsworth, N. C., 6.00 in 11 hours. 14th and 15th, Vicksburg, 3.85; Pensacola, 5.62; Montgomery, 2.75; Mobile, 4.30; Fort Barrancas, Fla., 4.72; Fayette, Miss., 3.20; Auburn, Ala., 3.78. 15th, Nashville, 4.21; Grand Haven, 2.70; Memphis, 2.51. 15th and 16th, Niles, Mich., 2.43; Wytheville, Va., 3.11; Independence, Ia., 2.15 in 7 hours; Highlands, N. C., 3.75. 15th to 17th, Ellsworth, N. C., 13.00 in 44 hours. 16th, Cedar Keys, 4.49; Aiken, S. C., 2.60. 16th and 17th, Augusta, Ga., 6.12. 17th, Marrietta, O., 2.35. 17th and 18th, Wytheville, Va., 2.20; Highlands, N. C., 4.05. 23rd, Smithville, 2.24. 24th, Alpena, 2.50. 25th and 26th, Mobile, 6.01. 26th, Dubuque, 4.01; Port Eads, La., 4.19. 26th and 27th, Elsworth, N. C., 4.00; Fort Brady, Mich., 2.83. 27th, Coldwater, Mich., 2.27. 27th and 28th, Highlands, N. C., 3.25; Pierce City, Mo., 4.20. 28th, Vevay, Ind., 2.40; Litchfield, Mich., 3.00; Fort Scott, Kan., 2.79; Fort Smith, Ark., 2.72. 28th and 29th, Manhattan, Kan., 3. 27; Fort Snelling, Minn., 3.04; Howard, Nebr., 5.80 in 26 hours. 29th, Northfield, Minn., 2.43; Logan, Ia., 2.40; Omaha, 3.67; Neillsville, Wis., 3.70; St. Paul, 2.68; Duluth, 2.88; Nora Springs, Ia., 4.00; Marquette, 4.44. 30th, Dubuque, 2.27; Fort Scott, Kan., 5.18 in 9 hours; Decatur, Tex., 4.44; Mason, 3.21; Springfield, Ill., 2.74; Jacksboro, 3.27; Brackettville, 2.52; Nelson, Tex., 4.00 in 1 hour and 30 minutes; Fort Gibson, 2.50; Brunswick, Mo., 2.50; Boonville, Mo., 3.18.

Largest Monthly Rainfalls.—Elsworth, N. C., 26.50 inches; Neillsville, Wis., 14.01; Highlands, N. C., 13.40; Nora Springs, Ia., 13.05; Marquette, Mich., 12.71; Howard, Neb., 12.36; Caldwell, Kan., 12.15; Mobile, 11.71; Embarrass, Wis., 11.60; Duluth, 11.52; Franklin, N. C., 11.35; Wellington, Kan., 11.19; La Crosse, 10.87; Key West, 10.71; Ft. Snelling, Minn., 10.54; Northfield, Minn., 10.27; Dubuque, 10.26; Independence, Ia., 10.20; Monticello, Ia., 10.15; Cresco, Ia., 10.03; St. Paul, 9.95; Belle Plain, Kan., and Minneapolis, Minn., 9.90; Escanaba, 9.48; Ft. Scott, Kan., 9.41; Independence, Kan., 9.11; Big Creek, Neb., 9.01; Chamois, Mo., 8.93; Milan, Kan., 8.90; Ft. Barrancas, Fla., 8.82; Yankton, Dak., 8.61; Ft. Brady, Mich., 8.53; Pensacola, Fla., 8.47; Omaha, 8.36; Yates Centre, Kan., 8.31; Smithville, N. C., 8.24; Madison, Wis., 8.17; Manitowoc, Wis., 7.85; Ames, Ia., 7.63; Guttenburg, Ia., 7.50; Sedalia, Mo., 7.42; Cedar Keys, Fla., 7.41; Niles, Mich., 7.36; Evansville, Ind., 7.30; Port Eads, La., 7.24; Punta Rassa, Fla., 7.20; Argyle, Kan., 7.10; Auburn, N. H., 7.02; Augusta, Ga., 7.01; Leavenworth, 6.89; South Haven, Kan., 6.85; Corning, Mo., 6.73; Grand Haven, 6.71; Muscatine, Ia., 6.59; Indianola, 6.51; Nashville, 6.49; Lexington, Mo., and Springfield, Ill., 6.43; Kansas City, Mo., 6.20; Alpena, 6.16; Mt. Washington, 6.13; Vicksburg, 6.11; Winfield, Kan., 6.10.

Smallest Monthly Rainfalls.—Anaheim, Brentwood, Brighton, Byron, Colton, Ft. Yuma, San Gorgonio, Turlock, Stockton, Tracy, Summit, Martinez, Woodland, Menlo Park, Monterey, Modesto, Kingsburg, Tulare, Sumner, Mojave, Ravenna, Newhall, San Fernando, Spadra, White Water, Indio and Mammoth Tank, Cal.; Pioche, Reno, Wadsworth, Beowawee, Elko, Halleck, Wells, Toano and Tecoma, Nev.; Kelton, Promontory and Terrace, Utah; Eagle Rock, Idaho; Terry's Landing, Mont., and Casa Grande, Ariz., none; Los Angeles, Livermore, Boca and Antioch, Cal. and Ft. McDermit, Nev., trace; Campo, Delano and San José, Cal., 0.02 inch; Poway and Goshen, Cal., 0.03; San Diego and Solidad, Cal., and Browns, Nev., 0.04; Borden, Truckee and Tuohey's Ranche, Cal., Yuma, Ariz. and Ft. Washakee, Wyo., 0.05; Miles and Tennant,

Cal., and Hot Springs, Nev., 0.08; Pt. San Jose and Visalia, Cal. and Eugene City, Or., 0.09; Salinas City, San Buenventura, Oakland and Ione Cal., Carlin and Golconda, Nev., 0.10; Otego, Nev., and Texas Hill, Ariz., 0.12; Caliente, Napa and Pleasanton, Cal., and Palisade, Nev., 0.13; Merced, Cal., 0.14; Humboldt, Nev., 0.15; Battle Mountain and Winnemucca, Nev., and San Mateo, Cal., 0.16; Farmington and Presidio, Cal., 0.17; Lathrop, Cal. and Ft. Bridger, Wyo., 0.18; Lemoore and Rio Vista, Cal., 0.20; Davis, Cal., 0.23; Bidwell, Galt and Hollister, Cal., and Brookhaven, N. Y., 0.24; San Francisco and Alcatraz Island, Cal., and Boise City, Idaho, 0.25; Blue Creek Utah, 0.29; Ft. Gaston, Petaluma, Rocklin, Sacramento and South Valejo, Cal., and Linden and Somerville, N. J., 0.30; Pajaro and Suisun, Cal., and Carson City, Idaho, 0.31; Tehachapi, Cal., 0.32; Gilroy, Cal., 0.34; Milton, Port Angeles and Tehama, Cal., and Ft. Keogh, Mont., 0.35; Corinne, Utah and Williams, Cal., 0.37; Southington, Conn., 0.38; Santa Cruz, Cal., 0.39; Knight's Landing, Cal., 0.42; Salt Lake City, 0.43; Angel Island and Willows, Cal., 0.44; Belvidere, Ill., Catawissa, Pa., and Mt. Ida, Ark., 0.45; Fresno, Cal., 0.46; Calistoga, Cal., 0.48; Maricopa, Ariz., White Plains, Cal., Delaware Breakwater, Del. New Brunswick, N. J., and Ft. Douglass, Utah, 0.50

Rainy Days.—The number varied in New England from 7 to 16; Middle Atlantic states, 4 to 13: South Atlantic states, 4 to 18; Florida Peninsula, 18 to 22; East Gulf states, 7 to 13; West Gulf states, 6 to 17; Rio Grande valley, 5 to 11; Ohio valley and Tennessee, 9 to 13; Lower Lake region, 9 to 16; Upper Lake region, 13 to 20; extreme Northwest, 5 to 15; Upper Mississippi valley, 7 to 21; Missouri valley, 12 to 17; Northern slope, 6 to 10; Middle slope, 3 to 7; Southern slope, 4 to 8; Southern Plateau, 2 to 7; Middle Plateau, 0 to 3; Northern Plateau. 0 to 13; North Pacific region, 7 to 12; Middle Pacific region, 1 to 3; South Pacific region 0 to 1,

Cloudy Days.—The number varied in New England from 2 to 13; Middle Atlantic states, 1 to 10; South Atlantic states, 1 to 9; Florida Peninsula, 3 to 10; East Gulf states, 3 to 6; West Gulf states, 2 to 9; Rio Grande valley, 2 to 10; Ohio valley and Tennessee, 3 to 8; Lower Lake region, 2 to 11; Upper Lake region, 5 to 15; extreme Northwest, 5 to 10; Upper Mississippi valley, 6 to 11; Lower Missouri valley, 4 to 9; Northern slope, 3 to 10; Middle slope, 3 to 4; Southern slope, 4 to 8; Southern Plateau, 1 to 5; Middle Plateau, 0 to 2; Northern Plateau, 2 to 8; North Pacific region, 4 to 8; Middle Pacific region, 0 to 1; South Pacific region, 0 to 4.

Snow.—Pagosa Springs, Colo., 6th, on mountains; Fort Shaw, Mont., 28th; Fort Assinnaboine, 27th; Ft. Bridger, W.T., 6th, 27th, 28th, 29th; Ft. Washakee, W. T., 5th, 6th, 29th; Genoa, Nebr., 16th, slight fall; Missoula, Mont., 19th, on surrounding mountains; Eagle Rock, Idaho, 2nd, 3rd, 25th, 29th; Dayton, Wash. Ty., 28th; Pomeroy, Wash. Ty., 27th; Winnemucca, 23rd, on mountains; Salt Lake City, 23rd, on mountains; Deadwood, 5th, 6th, 29th, 30th; Fort Meade, Dak., 6th; Cheyenne, 6th, 26th, 27th, 29th; Fort Custer, Mont., 30; Deer Lodge, Mont., 24th, 29th; Fort Shaw, Mont., 28th; Helena, Mont., 29th; Fort Ellis, Mont., 24th to 26th, 29th, 30th; Superior City, Mont., 25th; Missoula Ferry, Mont., 10th to 16th; Fort Assinnaboine, Mont., 5th, 6th, 30th; Denver, 8th, on mountains; St. Vincent and Moorehead, Minn., 4th; Omaha, 16th; Des Moines, 16th, between this city and Atlantic, several inches; Carson City, Nev., 22nd, on mountains west of station; McGregor, Iowa, 16th, snow fell all day in the northwestern portion of the State, the storm moving from NW. to SE., and reaching eastward to Algona, Kossuth Co., where it fell to the depth of four inches; Creston, Iowa, 16th, quite heavy; a general snow storm was reported from southern Minnesota; Stuart, Iowa, 16th, between this point and Avoca on the Rock Island Railroad, four to six inches reported.

Snow from a Cloudless Sky.—Cheyenne, Wyo., 29th, 3.55 p. m., lasting 15 minutes.

Hail storms of unusual violence were reported as follows: Mankato, Minn., 2d, most violent ever known in this section; hailstones 15 inches in circumference were picked up after the storm had passed; several persons were seriously injured by the falling hail. There was considerable wind and a perfect deluge of rain after the hail. Owantonna, Minn., 2d, wind shifted from northwest to south as the storm advanced, the hail breaking all windows on the south and west exposures. Lawrence, Kan., 29th, hailstones two inches in diameter fell in large quantities; every window on the north side of Massachusetts avenue broken; a heavy wind accompanied the hail, uprooting trees and unroofing some buildings. Moorehead, Minn., 4th, hailstones one inch in diameter, breaking all windows having western exposure. Morgantown, 1st, hailstones one-fourth inch in diameter.

RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, from 74 to 89; Middle Atlantic states, 64 to 87; South Atlantic states, 68 to 82; East Gulf states, 67 to 78; West Gulf states, 52 to 77; Rio Grande valley, 68 to 80; Ohio valley and Tennessee, 65 to 73; Lower Lake region, 67 to 72; Upper Lake region, 70 to 82; extreme Northwest 66 to 79; Upper Mississippi valley, 62 to 80; Missouri valley, 66 to 78; Northern Slope, 46 to 66; Middle Slope, 45 to 61; Southern Slope, 53 to 71; Southern Plateau, 47 to 60; Middle Plateau, 25 to 34; Northern Plateau, 37 to 67; North Pacific region, 69 to 81; Middle Pacific region, 40 to 77; South Pacific region, 49 to 73.

WINDS.

The prevailing winds during the month of August, 1881, at Signal Service stations, are shown on chart No. II by arrows which fly with the wind. In the South Atlantic and Gulf states, including Texas, *southeasterly*; Middle Atlantic states and New England, *southeast* to *southwest;* Lake region and Southern Plateau, *southerly;* Eastern Rocky Mountain slope, *northwesterly;* Northern and Middle Plateaux and the Pacific coast regions, *westerly.*

Total Movements of the Air.—The following are the largest total movements at the Signal Service stations: Mt. Washington, 25,957 miles; Fort Sill, Indian Territory. 10,565; Dodge City, 10,137; Delaware Breakwater, 10,039; New Shoreham, R. I., 9,884; Chincoteague, Va., 9,837; Henrietta, Texas, 9,751; North Platte, 9,645; Fort Elliott, Texas, 9,165; Eagle Rock, Idaho, 8,968; Decatur, Texas, 8,887; Cape May, 8,874; Portsmouth, N. C., 8,563; Kittyhawk, 8,553; Concho, Texas, 8,375; Hatteras, 8,336; Indianola, 8,306; Barnegat, 8,272; Sandy Hook, 8,201; Port Eads, La., 8,199; Cape Henry, 8,194; Sandusky, 8,072; Huron, Dak, 8,039. The *smallest* are: La Mesilla, N. M., 864; Phoenix, 1,102; Lynchburg, 1,351; Silver City, N. M., 1,468; Memphis, 1,873; Augusta, Ga., 1,964; Lewiston, Idaho, 1,978; Florence, 2,021; Roseburg, 2,253; Tucson, 2,348; Visalia, 2,367; Missoula, Montana, 2,433; Montgomery, 2,525; Brownsville, Tex., 2,541; Morgantown, 2,590; Knoxville, 2,629; Springfield, Mass., 2,652; Campo, Cal., 2,692; Nashville, 2,696; Olympia, 2,734; El Paso, 2,834.

High Winds.—Winds of 50 miles per hour and over were reported as follows: On summit of Mt. Washington, 1st, 5th to 9th, 11th, 15th, 19th to 28th, 30th; maximum velocities of 90 miles NW., occurred on 1st, 22d, 23d; Duluth, 78, NE., 16th; Wilmington, 64, W., 9th; Smithville, 60, NE., 9th; Eagle Rock, 55, SW., 24th; Grand Haven, 54, SW., 4th; Cedar Keys, 50, S., 24th; Dodge City, 50, W., 10th; Fort Assinnaboine, 50, W., 24th; Macon, 50, SE., 9th; Moorehead, Minn., 50, NW., 4th.

Local Storms.—Wilmington, N. C., 9th, most violent storm for many years; signals were ordered up at 9.30 a. m. with a telegram from the Chief Signal Officer to the effect that a hurricane was central on the North Carolina coast which would probably move northward. At 9.45 a. m. barometer fell to 29.805; 10.45 a. m., 29.626; 10.56 a. m., 29.620; 12 m., 29.390; 1 p. m., 29.302; 2 p. m., 29.502; 2.56 p. m., 29.694. Storm centre passed station at 1 p. m., when the wind veered from east to southwest and west, suddenly increasing from a gale to 90 miles per hour and continuing at that velocity for about 5 minutes when the connections of the anemometer were broken. Many buildings were unroofed and demolished and trees and fences generally leveled to the ground. Loss estimated at $100.000. No such storm since the years 1822 and 1838 when, according to report, the destruction of property was very great. Maryville, Mo., 29th, during the night town visited by a violent southwest wind storm; the large smoke stacks of the woolen mills and Wabash elevators blown down, also the ticket office, amphitheatre and 600 feet of the new stables on the grounds of the Fair Association; throughout the city houses were unroofed, trees uprooted and numerous out-buildings destroyed. Wrightsville, N. C., 9th, 5.30 a. m., indications of a very severe storm which had been threatening for some days. 7 a. m., wind became brisk and by 8. a. m., boats were drifting away and marsh hens were flying; 9 a. m., tide marked a height never before witnessed; water washed over the turnpike carrying large quantities of earth out to sea, and rendering the road impassable; some bath houses were washed away and others destroyed. 11 a. m., wind blew with extreme violence, uprooting trees and sweeping away the grand stand at the Banks; 12 m., wind shifted from east to southwest and west, blowing with redoubled fury, crushing buildings and tearing up the largest trees. Smithville, N. C., 9th, most violent storm for past 50 years; town covered with fallen trees, scattered fences and the debris of demolished buildings; all pilot boats in the harbor were sunk, and loaded vessels driven ashore; at 10 a. m. a maximum velocity of 60 miles per hour from the NE., barometer fell to 29.22, lowest; rising rapidly thereafter as the storm centre passed; 5.30 p. m., storm abated. Augusta, Ill., 24th, 4 to 5 p. m., several buildings leveled to the ground, trees uprooted and fences scattered; considerable loss to farm property. Golden, Ill., 24th, 5 p. m., violent northwest storm unroofing houses, uprooting trees and causing much other damage. Dutch Town, Ill., 24th, 4.30 p. m., the village, consisting of 6 houses, 1 church and a school-house, was entirely destroyed; loss about $8,000. Port Byron, Ill., 24th, 4 p. m., heavy wind storm of about five minutes duration; trees, fences and several frame buildings were demolished; two of the principal business blocks were unroofed; track of storm less than a mile wide. Joliet, Ill., 24th., 4 p. m., most destructive ever known; several buildings demolished and many more unroofed; one bridge destroyed and another badly damaged; loss from $7,000 to $10,000. Clayton, Ill., 24th, 5 p. m., telegraph lines down in all directions; tornado passed three miles to the northeast of station, sweeping everything before it; in the village signs, awnings, fences and chimneys were destroyed. Camden, Ill., 24th, 5 p. m., tornado passed from SW. to NE. through the town, containing 200 inhabitants, completely demolishing every building and killing two persons; "it was the work of an instant." Coatsburg, Ill., 24th, city considerably damaged by a violent storm of wind and rain, which passed over about 4.30 p. m. Ursa, Ill., 24th, violent wind storm, wrecking trees, fences,

and out-buildings. Marcelline, Ill., 24th, trees uprooted and fences, signs and awnings scattered; storm passed in a northeasterly direction. Nebraska City, Neb., 29th, 5 p. m., violent tornado passed over the village from SW. to NE., destroying several buildings and unroofing the B ind Asylum and several stores. Madison, Neb., 29th, during the night a large portion of the town, containing 1,000 inhabitants, was destroyed by a tornado moving in a northeasterly direction. This was probably the storm which visited Stanton, situated to the east-northeast, on the Sioux City R. R. Oswego, Kendall Co., Ill., 29th, very violent wind storm passed in a northeasterly direction over the southwest portion of the county, causing great destruction of farm property, principally barns, corn-cribs, cattle-sheds and orchards; path of storm narrow and often of peculiar shape. Farmersville, Jasper County, Ia., 29th, violent wind storm from the southwest; 20 miles south of station, passenger train wrecked by the gale; all telegraphic communication between this station and Fort Dodge cut off. Iowa Falls, Hardin Co., Ia., 29th, several freight cars thrown over by the force of the wind, obstructing all travel; considerable destruction in surrouding country; this storm was quite severe at Ackley in the same county. Des Moines, 29th, heavy squall, blowing down trees and out-buildings. Caldwell, Kan., 29th, several houses were entirely demolished and other buildings more or less injured; no such storm has visited this section in several years. Mantonia, Wis., 29th, a violent tornado swept down a valley a short distance west of the town, completely devastating a space 80 rods wide and about six miles in length; many houses, barns, out-buildings and one grist mill were demolished: twelve persons were seriously injured, but none killed outright; loss estimated at $60.000. Wellsville, Pa., 2nd, many buildings blown down, trees uprooted and live stock killed; heavy damage was reported from northern portion of state and in southwestern New York. Dyck's Switch, N. Y., 2nd, heavy northwest storm, several buildings unroofed and considerable loss to railroad property. Ackley, Ia., 30th, violent wind storm unroofing several buildings, destroying fences and uprooting trees. Eldora, Ia., 29th, Re orm School building blown down, and much other damage caused. Manhattan, Kan., 29th, 6 p. m., violent tornado 3½ miles east of station; storm passed in a northeasterly direction on the south side of the Kansas river; several houses were entirely demolished and considerable timber destroyed. Winterville, Ga., 15th, violent wind storm, tearing up trees, scattering fences and destroying cotton; several buildings more or less damaged. Quincy, 24th, 5 p. m., 21 buildings demolished and about 50 unroofed, trees uprooted, fences torn down and telegraph communication completely cut off; 9 persons were killed by falling *debris;* track of storm about two miles wide; streets of city thickly strewn with *debris*; storm accompanied by terrific thunder and lightning; loss estimated at $100.000. Abilene, Kan., 29th, throughout the day Dickinson County experienced the strangest weather ever known in the state; dense and threatening clouds would roll up in different parts of the heavens as if by magic accompanied by fitful gusts of wind, some of which were of extreme violence; at noon the storm came up with unusual power, blowing in windows, destroying chimneys and unroofing buildings; Presbyterian church entirely demolished; losses estimated at $15.000 Centralia, Boone Co., Mo., 29th, violent wind storm passed from southwest to northeast five miles south of station; several buildings demolished and two persons killed. Yuba, Traverse Co., Mich., 24th, violent northwest storm unroofing buildings, scattering fences and blowing down trees; at Kingsly station, several buildings blown down causing a loss of several thousand dollars. Petoskey, Mich., 24th, much timber blown down, in some cases obstructing railroad travel; out-buildings and fences general destroyed in the path of the storm. Duluth, 16th, 8 a. m., violent northeast storm, maximum velocity at 9.15 a. m., 78 miles per hour, continuing for 15 minutes, while for four hours the wind blew at an average rate of 41 miles per hour throwing the waves of the lake into mountainous seas, the spray in some instances rising to the height of 104 feet. The old light-house was destroyed by the waves and the wharves badly damaged. At the junction of First avenue and the railroad switch yards, the waves rushed over the piers, carrying huge pieces of stone and driftwood which blocked up the tracks so that railroad travel was suspended for some time. The tracks of the St. P. and D. R. R., were completely buried beneath a mass of drift wood and rocks; nine car loads of flour were badly damaged and the oil house near the depot buildings totally destroyed. The damage to buildings along Minnesota Point was quite severe; 8 or 10 buildings were moved from their foundations and several entirely washed away. 1,000,000 feet of logs at Gray's Mill were swept out by the waves. This storm proved to be the most violent within the memory of the oldest inhabitants of the city. The two most destructive storms, since the advent of railroads, occurred on November 13th, 1872, maximum velocity 36 miles, and October 16th, 1880, maximum velocity 30 miles per hour. These winds were from the NE. and therefore more destructive as compared with other much higher velocities, but not from the right direction to cause much damage. Holt Co., Mo., 26th, 5.30 p. m., tornado crossed the Missouri river in section 27 township 60, range 29 N. passing from SW. to NE. over the Big and, Little Tarkio rivers, thence through the town of Maitland, thereafter crossing the Nodaway river and moving some distance in Nodaway Co. Farms in the path of the storm were wrecked of everything, and at many places where the whirling cloud touched the ground the latter had the appearance of being washed, the stubble and grass being bent toward the

northeast or in the direction of the moving storm-cloud. At the town of Maitland, buildings were moved from their foundations and several unroofed. Clare, Clare Co. Mich., 22d, terrific hurricane during the night accompanied by violent thunder and lightning; great damage to property over a wide extent of country. In vicinity of Atwood's stations over 2,000,000 feet of timber was blown down; trees were "snapped off like pipe-stems" and the work of destruction was awful in its suddenness and completeness. Lansing, Ingham Co., Mich., 22d, very violent wind storm with terrific lightning, property destroyed to the value of $25,000. Elmira, N. Y., 25th, gale lasted about 2 minutes, during which time it unroofed a large hotel, carried the roof of the Palace car shops over and several hundred feet beyond the adjoining freight building. Many houses were unroofed and windows blown out, church steeples thrown over and trees uprooted or broken off close to the ground. Rain fell in torrents, increasing the already serious loss of property. Owatonna, Minn., 29th, most destructive storm in the history of this region; about 100 small structures were more or less damaged; loss estimated at $10,000. Wautoma, Wis., 29th., about 5 p. m. violent tornado passed near station from SSW. to NNE. through the counties of Washara and Waupaca. Preceding the storm, clouds in the western heavens looking like great sheets of white smoke, were dashed about in the wildest manner and finally combining in a long spout-like mass descended to the earth, over which it moved with great speed. Houses, barns and out-buildings in the path of the storm were completely torn to pieces; fences were strewn over the woods, corn fields swept clean, hay and grain stacks destroyed and the largest trees "snapped off like pipe-stems;" whole destruction consumed about 15 minutes. Width of storm path 80 rods, length 12 to 15 miles. In passing over Sandbar lake the storm formed a water-spout which carried up a great quantity of water and considerable fish upon the adjoining land. Stanton, Stanton Co., Nebr., 29th., about 9 p. m., tornado passed from SW. to NE., destroying a portion of the town; storm came up with a rushing, roaring noise like a heavy stock train and passed through the village with lightning rapidity, "it was gone in an instant." People were crazed by the sudden and awful awakening from slumber, and many were stripped of clothing, drenched with rain and severely injured by flying *debris*. Ten houses were completely leveled to the ground; path of storm about 300 yards wide. Emporia, Kans., 29th, 6.30 p. m., north and west of this city a terrible wind storm passed from WNW. to ESE. down the valley of the Neosho detroying an immense amount of farm property and killing 4 persons; 42 buildings were completely demolished and 10 to 15 more or less injured. Most destructive storm since the terrible tornado of 1878, and passed over about the same path as the tornado of June, 1881. Between Emporia and Howard the storm expended itself in an unusually heavy fall of rain accompanied by the most terrific display of lightning. At one place in the storm's path a flock of sheep valued at $5,000 were all killed. Width of track from 3 to 100 rods; through the timber on Neosho river 30 rods. Lind, Wis., 29th, about 7 p. m., tornado, doing a vast amount of damage in town and country; in the former five buildings were completely blown to pieces and several others badly damaged. Centralia, Nemaha Co., Kans., 29th, about 6 p. m., violent wind storm five miles south of station; several buildings and much farm property destroyed.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for September, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 86.47 per cent. The percentages for the four elements are: Weather, 89.94; Direction of the Wind, 80.80; Temperature, 89.21; Barometer, 85.59 per cent. By geographical districts they are: For New England, 83.42; Middle Atlantic states, 87.61; South Atlantic states, 90.12; Eastern Gulf states, 91.08; Western Gulf states, 92.47; Lower Lake region, 84.98; Upper Lake region, 84.19; Tennessee and the Ohio valley, 86.57; Upper Mississippi valley, 83.87; Lower Missouri valley, 78.62; Northern Pacific coast region, 90.90; Central Pacific coast region, 100.00; Southern Pacific coast region, 100.00. There were 77 omissions to predict (47 being due to the absence of reports from the Pacific coast), out of 3,690, or 2.08 per cent. Of the 3,613 predictions that have been made, 111, or 3.07 per cent are considered to have entirely failed; 131, or 3.63 per cent. were one-fourth verified; 371, or 10.27 per cent. were one-half verified; 373, or 10.32 per cent. were three-fourths verified; 2,627, or 72.71 per cent. were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals.—Seventy-seven Cautionary signals were displayed during the month, of which, 63, or 81.82 per cent. were fully justified by winds of twenty-five miles per hour or over, at or within a radius of 100 miles of the station. Two Off-shore signals were displayed, neither of which were fully justified; one was justified as to direction only, and the other failed with regard to both direction and velocity. Seventy-nine signals of both kinds were displayed, of which 63, or 79.75 per cent. were fully justified. The above does not include signals ordered at display stations where the velocity is only estimated. Seventy winds of twenty-five miles or over were reported for which no signals were ordered. Twenty signals were ordered late.

NAVIGATION.

Stage of Water in Rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed at Signal Service stations during the month of

September, 1881. Throughout the month the principal rivers of the country have been extremely low, a remark which applies with equal if not greater force to the previous month of August. Comparing the highest readings of the gauge for the month of August, with those of September, it is found that the following changes have taken place during the latter month: Red River, +7 inches; Arkansas, —1 ft. 9 in.; Missouri, from —2 ft. 1 in. to —2 ft. 7 in.; Mississippi, —13 ft. 8 in. to +8 ft. 10 in.; Ohio, —1 in. to —3 in.; Cumberland, +9 in.; Tennessee, +3 ft. 2 in.; Monongahela, —1 in. to —1 ft. 3 in.; Savannah, +5 ft. 5 in.; Williamette, —4 ft. 6 in. to —5 ft.; Sacramento, + 1 in. At but two stations did the water approach the danger line, viz.: Keokuk and Davenport.

Floods.—Kansas: Caldwell, 29th, heaviest rain for years, over 14 inches fell in 10 hours; trains delayed by serious washouts; creeks and rivers overflowed, causing great damage to bridges, fields and highways. Eureka, 29th, rainfall immense and almost unparalled; all streams overflowed; railroad and highway bridges damaged. Emporia, 29th, heaviest rainstorm ever seen in this section; streets flooded in half an hour, causing considerable damage to property. Sumner Co., 29th, in the southern portion, heaviest rain for several years; at Wilmington rain continued for seven consecutive hours, 7.45 inches falling in that time; creeks and sloughs overflowed submerging the bottom lands for miles; haystacks and corn crops damaged to a considerable extent. *Missouri:* Kansas City, 29th, 3 p. m., terrific storm of wind and rain, lasting about two hours; water filled the streets, which, in a short time, resembled small rivers. Basements were flooded, streets badly cut and embankments carried away. Railroad tracks covered with debris from falling walls and embankments, to such a degree as to prevent all travel for some time. Loss to private and city property about $20,000. *Minnesota:* Spirit Lake, 16th, all railroad travel suspended by heavy washouts; very heavy rains for the past two days. St. Paul, 29th, all rivers and smaller streams flooded by the continued heavy rains; trains on the various railways delayed by washouts and land slides. At Minneapolis there was a jam of 20,000,000 feet of logs in the Mississippi, greatly endangering contiguous property. On the Minnesota the low lands were flooded on both sides of the river causing great loss to the hay crop. Marine, 29th, mill-dams carried away by the high water; bridges over Brown's creek and Fairy Hall creek washed out; low lands flooded. *Michigan:* Marquette, 29th, heavy washouts on railroads. Escanaba, 26th, streets badly washed and cellars flooded to depths of from 2 to 3 feet. *Nebraska:* Omaha, 29th, streets badly washed and basements flooded; high winds breaking down trees and scattering fences. *Texas:* San Antonio, 10th, streets flooded; creeks and rivers overflowed. *New York:* Elmira, 25th, rain fell so heavily that the sewers were unable to take the water off and immense damage was done to household goods by the water backing up and into the houses. *North Carolina:* Elsworth, much damage done the W. N. C., R. R., by the remarkably heavy rains of the 14th to 17th; several land slides on the mountain section and heavy washouts delayed all railroad communication until the 20th; monthly rainfall 26.50 inches. *Wisconsin:* Wausau, 29th, highest water ever known on the Wisconsin river, water rose at the rate of 4 inches an hour during the day; river 21 inches higher than the June flood of 1880; rainfall during 24 hours over 7 inches: 2,000 000 feet of logs washed away, together with a large quantity of lath and shingles; several houses washed away; all business suspended. La Crosse, 29th, all small streams flooded; in Coon valley the damage from high water is very heavy; all country bridges washed away; farmers have been unable to thresh and grain is sprouting in the stacks, which have been greatly damaged by water. Stewart, 29th, more water on the ground than at any time previous during the year; grain stacks nearly ruined by the continued driving rains.

Drought.—Connecticut: Southington, 30th, vegetation suffering severely; great scarcity of water. *Florida:* Houston, 30th, month very dry, all kinds of crops suffering for want of rain. *Indiana:* Vevay, 6th, Ohio river lower than ever known before. *Kentucky:* In central and eastern portions of state, 3rd, no rain in past 6 weeks. *Maryland:* Fallston, 30th, month remarkably dry, many crops have entirely failed, while all have suffered severely. Sandy Springs, 30th, vegetation suffering from an unprecedented drought. Woodstock, 30th, wells and springs very low, crops suffering. *Michigan:* Sanilac county, 17th, drought has been excessive and the effect upon crops very serious; the air is filled with dust and smoke, and all vegetation is parched. *New Jersey:* Trenton, 2nd, crops and cattle suffering from drought which extends the whole length and breadth of the state. In the northern part of Hudson, Co., where water supply is entirely derived from wells, the residents are compelled to haul water from Jersey City and Hoboken and pay as high as $10.00 a load. The North Hudson R. R. Co., who have 600 horses at West Hoboken cart all their water in large iron tanks. From Burlington Co., it is reported that the Delaware and all the neighboring streams are unusually low; wells, cisterns and springs are nearly exhausted; corn crops and pastures are burning up; not even a vestige of green can be seen in many fields. Cape May, 4th, crops suffering severely; farmers report vegetables to be almost burned in the ground. Freehold, 30th, surrounding country very dry; crops below the average. *New York:* Buffalo, 2nd, very severe, farm products are very poor and short of the usual crop. Rochester, 2nd, grass and pastures are burned up and fruit is suffering severely; wells and streams dry; the surrounding country in great distress. Mc Kean and Allegheney counties, 3rd, 1000 oil wells shut down for lack of water to run engines; no rain has fallen for

over a month. Albany, 3rd, unless rain soon falls it will be difficult to fortell the result of the terrible and unprecedented drought now prevailing. A drought so general and devastating has never been known in this country before. For miles about, the streams, wells and cisterns are dry and water is brought from distant places and sold by measure in various places; fruit is falling from the trees prematurely ripened and decayed; pastures are parched and there is no nutriment in grass of any kind; leaves are coloring and falling as in the fall; potatoes are being dug to prevent rot and other crops are withering or rotting in the fields; streams are lower than ever known before and navigation is seriously impeded; railroads find it difficult to run trains, owing to the lack of water for steam and in consequence there are daily, serious blockades of freight on the N. Y. Central R. R. Troy, 3rd, the numerous industries of the town suffering great inconvenience from lack of water; there is one-third falling off in the amount of work turned out in the linen and iron manufactories; all the streams run dry and several kinds of work suspended. In most instances people at the south end of the city are compelled to take water for domestic purposes from the almost stagnant ponds in the vicinity. Water very low in the Waterford level of the Champlain canal owing to the scarcity of water in the Mohawk river; boats frequently aground; lowest water for many years. Westchester Co., 29th, drought is paralyzing business, it is the most disastrous ever experienced; all vegetation is parched and nearly devoid of life; grass is brown and dead, trees are leafless and gardens and fields look like deserts; in some places the earth is as dry as powder to a depth of six feet and when a breeze passes over it, the air is like the current from a hot oven; cattle have become thin and sickly from lack of sufficient food; not a ton of corn-fodder has been raised in the county. The county is practically without water; wells and springs, never known to fail before, are now dry; the Bronx river has ceased to run; on the principal streams of the county, Byram, Cross, Saw-mill and Croton rivers, all business suspended; small creeks and brooks gave out several weeks since; cattle are driven 3 to 5 miles for water, and then only that which is stagnant can be obtained. Villages are especially suffering from drought; water is drawn from a distance in barrels and sold to the consumer. At White Plains, Mount Vernon, Pleasantville, Kensico, Scarsdale, Mount Kisco, Katonau, Croton Falls, Cheppaqua and other smaller villages, water is hauled from the neighboring rivers, which are now nearly dry. Croton Lake is very low and New York City is compelled to draw upon the storage reservoirs at Lake Mahopac and upon the upper reservoirs in Putnam county. Daysville, 19th, wells, cisterns and most of the streams entirely dry. Hannibal, 17th, the most terrible drought that ever visited this section; grass virtually dead; no food for stock except what has been stored for winter; wells and streams dry, people and animals suffering for water. *North Carolina:* Life-saving Station No. 6, 30th, the long continued drought has had a marked effect upon the sea-coast. The beach grass, affording an immense pasturage for thousands of cattle, has prematurely dried up, rendering the removal of the stock absolutely necessary before winter. Good drinking water cannot be obtained, that drawn from wells having a decided brackish taste. Corn and vegetation has generally failed. A serious type of sore throat has made its appearance, resulting fatally in nearly every instance; it is attributed to the extreme aridness of this section. The numerous creeks and ponds on the south side have stagnated, causing an unprecedented spread of malarious and climatic fevers. Kittyhawk, 30th, very severe during the month. Hatteras, 2d, great suffering for rain. *Ohio*: Leetonia, 10th, a most terrible drought still continues, the earth is baked and vegetation withered; no such weather ever experienced before. The sun appears like a large ball of fire suspended in the heavens, and the atmosphere is heated to a degree almost intolerable; schools have been closed until the 1st of October, and the rolling mills and tool works have suspended operations because of the excessive heat and unprecedented lack of water. Columbus, 9th, the extreme drought causes great suffering; city enveloped in smoke. *Pennsylvania*: Catawissa, 30th, owing to long continued drought trees are generally dying; pastures destroyed and farmers are feeding their cattle with hay; fall seeding delayed; the earth is like an ash heap to a depth of 4 feet; the North Branch of the Susquehanna is five inches lower than the lowest point ever before recorded; small brooks that have never failed are now dry. Fallsington, 30th, wells, springs and small streams are generally dry; farmers have not put in their fall wheat owing to the baked condition of the soil. In the northwestern portion of the state, which is principally a dairy country, the loss to crops and dairy interests can hardly be estimated; corn will yield about half a crop, grapes about one-third and other small fruits are drying up or rotting on the trees. Erie, 5th, stock suffering severely; crops seriously damaged; many small streams entirely dry. *Tennessee*: Chattanooga, 12th, river lower than at any time since 1839; crops seriously damaged. 13th, river reached zero point on gauge corresponding with the low water mark of 1839, which is the lowest ever known at this point. Memphis, 30th, correspondence of the cotton exchange in this and neighboring States report very unfavorable prospects for the cotton crop owing to the severe drought. *Virginia:* Fredericksburg, 2nd, unprecedent in the history of northern Virginia; in some places rain has not fallen for three months; there is no food for cattle, and in some cases people have traveled 30 miles for feed. On the upper Rappahannock water is hauled long distances for household uses. Ft. Myer, 10th, crops in surrounding country, greatly injured from drought.

Water Spouts.—Key West, 10th, 1.20 p. m., two water spouts were seen 7 miles WNW. from station, moving from E. to W.; one was complete, extending from a cumulo-stratus cloud to the water; the other was from the same cloud, but was only partially formed; it descended from the cloud but did not connect with the water; the phenomenon lasted for 25 minutes. Hatteras, N. C., 4th, 12 m., a large water spout was observed in the sound, about 3 miles north of station. When first observed, it was fully formed and extended from a heavy cumulo-stratus cloud, of black appearance, to the water, apparently a distance of half a mile. The spout was of a light grayish color near the water and of much darker color near the cloud; the water at its base seemed much agitated and was raised to a height of from 3 to 4 feet for several rods around. The water could be distinctly seen ascending the spout rapidly, with a spirally upward motion. The spout lasted for five minutes, when it broke; ten minutes elapsed before the column was fully drawn up and had disappeared within the cloud.

High Tides.—Indianola, 28th, 29th, 30th; Portsmouth, N. C., 3d, 13th; New Haven, 9th, 10th.

TEMPERATURE OF WATER.

The Temperature of Water, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left-hand side of chart No. III. Owing to loss of instrument, observations at Charleston are wanting on the 9th, and from the 24th to the 30th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—In the various districts they were reported as follows: New England, 1st to 7th, 11th, 13th, 22nd to 24th, 26th to 29th; Middle Atlantic states, 1st to 3rd, 5th, 9th to 12th, 22nd, 23rd, 25th to 29th; South Atlantic states, 3rd, 4th, 7th, 9th, 11th, 12th, 13th, 17th, 26th, 27th; Eastern Gulf states, 8th, 10th to 19th, 26th to 28th; Florida Peninsula, 1st to 7th, 10th to 16th, 19th, 21st, 22nd to 27th, 30th; Western Gulf states, 1st, 6th to 10th, 12th, 13th, 27th, 29th, 30th; Rio Grande valley, 1st, 6th, 7th, 8th, 10th, 11th, 13th, 27th, 29th, 30th; Ohio valley and Tennessee, 1st to 4th, 8th to 11th, 13th, 14th, 18th, 19th, 21st, 23rd to 28th, Lower Lake region, 1st to 5th, 9th, 10th, 12th, 22nd to 27th; Upper Lake region, 1st to 6th, 8th to 10th, 14th to 18th, 21st to 30th; Upper Mississippi valley, 1st to 12th, 14th, 15th, 21st to 30th; Missouri valley, 1st to 6th, 9th to 15th, 19th, 22nd to 30th; extreme Northwest, 3rd, 4th, 9th, 11th, 13th, 19th, 20th, 24th; Northern Slope, 1st to 4th, 18th, 19th, 21st to 23rd, 28th, 29th; Middle Slope, 1st, 5th, 6th, 9th, 18th, 22nd, 23rd, 25th, 26th to 29th; Southern Slope, 5th, 6th, 12th, 26th to 29th; Southern Plateau, 3rd, 4th, 10th to 13th, 28th; Middle Plateau, 23rd; Northern Plateau, 2nd, 4th, 8th, 13th, 17th, 24th; North Pacific coast region, 4th, 8th, 17th, 22nd, 23rd; Middle Pacific coast region, 1st, 2nd, 21st to 27th.

Atmospheric Electricity Interfering with Telegraphic Communication.—Dodge City, Kan., 29th; Ft. Elliott, Tex., 28th; Jacksboro, Tex., 7th, 27th and 29th; Eagle Pass, Tex., 8th and 29th; Brackettville, Tex., 30th; Bismarck, Dak., 19th.

Zodiacal Light.—Nashville, 5th, 6th, 11th, 12th, 16th, 17th, 19th to 25th and 30th; Wood's Holl, Mass., 15th and 16th; New Corydon, Ind., 21st, 22d, 24th, 26th, 27th and 30th; Monticello, Ia., 1st.

Auroras.—The most remarkable display for several years occurred on the 12th, 13th and 14th, and the line of observation was continuous from Sydney, N. S., westward to Umatilla, Or. Observers reported its appearance as far south as Louisville and northward to St. Vincent, Minn. At several stations in Dakota and Minnesota the display began on the 11th, and probably on this date the districts eastward to the Atlantic would have reported the same phenomenon had it not been for the heavy cloudiness which prevailed from the Lake region eastward to Newfoundland, accompanying the progress of low area No. II. It is interesting to note in connection with this great electrical disturbance that on precisely the same dates, but during the previous month of August a remarkable auroral display was observed very extensively in England and Scotland. An observer at the Stonyhurst Observatory describes it as recalling the magnificent displays of 1869, 1870 and 1872, while the play of the magnets was one of the most violent ever recorded at that observatory. On the 11th, 12th and 13th of August observers of the sun found indications of intense commotion; sunspots were numerous, large and active and protuberances shot up from the sun's surface, with increased force and velocity. The earth appeared to make instantaneous response to the solar storm and a magnetic disturbance suddenly commenced by an unusual exhibition of earth currents. At the Greenwich Observatory no such magnetic disturbance had been recorded for many years. This auroral display was not only very extensive but exceedingly brilliant, and many of its manifestations wonderfully strange; in the United States but two stations reported, viz: Duluth, 13th, 11 p. m.; St. Vincent, 12th, 10 p. m. Concerning the display for the present month (September) the following stations, with few exceptions, report the time of appearance and disappearance: Sydney, C. B. I., 14th. Halifax, N. S., 13th, 14th. Eastport, Me., 12th, from 8 to 11 p. m.; 13th, from 8 to 10 p. m.; 14th, from 7 to 9 p. m. Bangor, Me., 12th, from early dusk until midnight. Cornish Me., 14th. Dexter, Me., 12th, 7 to 9 p. m.; 14th, 8 to 10 p. m. Mt. Washington, N. H., 12th, 7 to 10.20 p. m; 13th, 1.10 to 4 a. m., and from 7 to 8.40 p. m. Burlington, Vt., 12th, 7.15 to 9 p. m.; 14th, 8.30 to 10.30 p. m. Newport, Vt., 12th, 8 to 9 p. m.

Boston, 12th, 8 p. m. Newport, R. I., 12th, 7.30 to 8.30 p. m.; 13th, 1 a. m. to daybreak. New London, 12th, 9 to 9.45 p. m.; 13th, 2.10 to 2.38 a. m. New Haven, 12th, 7 to 9 p. m.: 13th, 1 to 3 a. m., also at 8 p. m. Cambridge, Mass., 12th, 8 to 8.45 p. m. Rowe, Mass., 12th, 8.30 to 9.30 p. m. Amherst, Mass., 12th, 9 p. m. Williamstown, Mass., 12th, 8 p. m.; 13th, 8 p. m.; 14th, 8.15 p. m. Albany, 12th, 8 p. m. to morning of the 13th. Oswego, 13th, 1 a. m. Waterburg, N. Y., 13th, 9 p. m.; 14th, 8 to 9 p. m. Ardenia, N. Y., 8 to 9 p. m. Rochester, 13th, 2 a. m. to daybreak. Buffalo, 13th, 1.30 a. m. Dyberry, Pa., 12th, 8.15 p.m. West Chester, Pa., 12th, 8 p. m. Fallsington, Pa., 12th, 8.15 to 9 p. m. Philadelphia, 12th, 8 p. m. Moorestown, N. J., 12th, 8.30 p. m. Freehold, N. J., 12th, 8 to 8.45 p. m. Atco, N. J., 12th, 8.30 p. m.; 13th, 9 p. m. Contoocookville, N. H., 12th, 8.30 to 9 p. m. Fallston, Md., 12th, 8 to 9 p. m Woodstock, Md., 12th, 7.45 to 8.45 p. m. Fort McHenry, Md., 12th, 9 p. m. Accotink, Va., 12th, 8 p. m. Fort Myer, Va., 12th, 7.30 p. m. Washington, D. C., 12th, 7.40 to 9 p. m. Morgantown, 12th, 8 to 9.30 p. m. Erie, 13th, 12.50 to 2.40 a. m. Toronto, 12th, 13th. Cleveland, 12th, 8 p. m.; 13th 2 to 4 a. m. Detroit, 12th, 7.20 to 11 p. m.; 13th, 12.20 a. m. to daybreak. Sandusky, 12th, 11.30 p. m. to 4 a. m. of 13th. Toledo, 12th, 7.50 p. m.; 13th, 3 to 4 a. m. North Lewisburg, Ohio, 12th, 8 p. m. Westerville, Ohio, 12th, 8 p. m. Wooster, Ohio, 12th, 8 p. m. Columbus, 13th, 12.10 to 1.35 a. m. Alpena, 12th, 8.30 p. m. to 4 a. m. of the 13th, and from 8.30 to 10.10 p. m.; 14th, 8.10 p. m. Port Huron, 12th, 11.30 p. m to 5.30 a. m. of 13th. Escanaba, 12th, 8 p. m. to daybreak of the 13th, and from 10.25 to 11.30 p. m.; 14th, 8.40 to 10 p. m. Marquette, 12th, 7.35 p. m. to 5 a. m. of the 13th; 14th, 8.45 to 9.45 p. m. Chicago, 13th, 1.10 a. m. to daybreak. Grand Haven, 12th, 7.30 p. m. to 4.30 a. m. of the 13th. Fort Brady, Mich., 13th, 9 p. m.; 16th, 9. p. m. Northport, Mich., 12th, 9 p. m. to morning of 13th. Lansing, Mich., 12th, 9 p. m. Litchfield, 12th, 8.30 p. m. Duluth, 12th, 7.20 p. m. to 5.20 a. m. of the 13th. Indianapolis, 13th, 3 to 3.22 a. m. New Corydon, Ind., 12th, 7.30 p. m.; 13th, 2 to 4.45 a. m. Elmira, Ill., 12th, 8 to 9 p. m. Morrison, Ill., 12th, 9 p. m. Riley, Ill., 12th, 8 p. m. to 3.40 a. m. of the 13th. Champaign, Ill., 12th, 10.15 p. m. to 3.30 a. m. of 13th. Madison, Wis., 12th, 10.30 p. m. to 5 a. m. of 13th. Dubuque, 12th, 7.43 p. m. to 1.22 a. m. of the 13th. Burlington, Iowa, 13th, 1 to 1.35 a. m. LaCrosse, 12th, 8 p. m. to 4.30 a. m. of the 13th. Milwaukee, 13th, 12.05 to 4.30 a. m. St. Paul, 12th, 10 p. m. to 4.30 a. m. of the 13th. Clinton, Ia., 12th, from shortly after sunset to 3 a. m. of the 13th. Cresco, Ia., 12th, 8.15 to 10.20 p. m. Independence, Ia., 12th, 8 p. m. to morning of the 13th. Monticello, Ia., 12th, 8 p. m.; 14th, 11 p. m. Mission House, Wis., 12th, 8 to 9.30 p. m.; 14th, 8 to 9.30 p. m. Embarrass, Wis., 13th, 2 a. m.; 14th, 8.30 p. m. Manitowoc, Wis., 12th; 14th. Beloit, Wis., 12th, 8 p. m. to midnight. Northfield, Minn., 12th, 8 p. m. to 4 a. m. of the 13th. St. Vincent, Minn., 11th, during the evening; 12th, 6.30 to 10 p. m.; 14th, from dusk to 10 p. m. Bismarck, 11th, 8 p. m.; 12th, 7 p. m. to 3 a. m. of the 13th; 14th, 8 p. m. Moorehead, Minn., 12th, 8 to 9.50 p. m. Fort Stevenson, Dak., 11th; 12th; 13th; 14th; Fort Meade, Dak., 12th, 1 to 2 a. m. Fort Snelling, Minn., 12th, 8 to 10 p. m. Huron, Dak., 12th, 9 p. m.; 13th, 2 to 4 a. m.; 14th, 9 p. m. to 3 a. m. of the 15th and from 8 p. m to midnight. Yankton, 12th, 10 p. m. to 5 a. m. of 13th. Davenport, 11.55 p. m. to 2.30 a. m. of 13th. Fort Bennett, Dak., 12th, 10 p. m. to midnight; 14th, 9.30 to 10.10 p. m. Ft. Sully, Dak., 13th, 9 p. m., to morning of 14th. North Platte, 12th, 11 p. m. to 1 a. m. of the 13th; 14th, 8 to 11.30 p. m. Clay Center, Kan., 14th, 10 p. m., a bow of light, due north, of a pinkish cast and the form of a rain-bow; no beams were seen. Fort Keogh, Mont., 12th, 10.15 p. m. Fort Benton, Mont., 12th, 10 p. m. Fort Shaw, Mont., 12th, 10.30 p. m. Colfax, Washington Ty., 14th, 8.30 to 10 p. m. Spangle, Washington Ty., 14th. Fort Lapwai, Idaho, 14th, 7.55 to 9.10 p. m. Mission, Idaho, 14th, 8.15 p. m. Dayton, Washington Ty. 14th, 7.30 to 9.30 p. m. Umatilla, Or., 14th, 8 to 9.10 p. m. The following stations reported the display as materially affecting telegraphic communication: Fort Shaw, Mont., 12th. La Crosse, 13th, great difficulty was experienced in working the telegraph lines; several operators were of the opinion that the instruments could have been worked without the assistance of battery. Buffalo, 13th, telegraphic communication much disturbed. Cleveland, 12th, wires strongly affected. Albany, 12th, telegraph companies were unable to use any of the quadruplexes and with difficulty the ordinary relay; interruption to business very serious between east and west, and continued until 10.30 a. m. of the 13th. New Haven, 13th, telegraphic communication seriously interrupted. Boston, 12th, telegraph wires rendered useless during the display. The display of the 23rd ranks next in importance to that of the 12th to 14th. Its appearance was not by any means as general, but its observance in an extreme southerly latitude makes it exceptional. Ithaca, N. Y., 10 to 11.30 p. m. Rochester, 10 p. m. Woodstock, Md., 9 to 10.15 p. m. Westerville, Ohio, 8 p. m. Augusta, Ga., 7 p. m., faint rose color, lasted 20 minutes; no arch. Riley, Ill., 8.30 to 11 p. m. Springfield, Ill., 8.20 p. m. Keokuk, 8.20 to 8.52 p. m. Dubuque, 8.20 p. m. Next in point of magnitude to that of the 23rd, was the display of the 20th, the following stations reporting: Sydney, N. S.; Halifax, from 8 to 9 p. m.; Eastport, 9.30 p. m.; Gardiner, Me., 11 p. m.; Cornish, Me., 9 p. m.; Burlington, Vt., 11 to 11.55 p. m.; Boston, 11 to 11.45 p. m.; Alpena, 10 to 11.30 p. m. The display of the 28th was quite generally observed in New England and the Upper Lake region, the following stations reporting: Gardiner. Me., 11.30 p. m.; Mt. Washington, 10 to 11.45 p. m.; Burlington, Vt., 11 to 11.15 p. m.; Alpena, 8.25 p. m. to 1.45 a. m. of the 29th. Escanaba, 10 to 11.45 p. m.

Marquette, 10 to 11.45 p. m. The following were local displays of more or less brilliancy: Eastport, 29th, 8 p. m. to midnight; 16th, 9.30 p. m. Burlington, Vt., 16th, 7 to 11.30 p. m.; 25th, 11 p. m. to 1.30 a. m. of 26th. Boston, 30th, 11 p. m. Ithaca, N. Y., 30th, 9.30 p. m. Morgantown, 15th, 1 a. m. Bellefontaine, Ohio, 10th, 7.25 p. m. to 4 a. m. of the 11th. Alpena, 15th, 8.35 p. m. to 2 a. m. of the 26th. Fort Brady, Mich., 25th, 9 p. m. Northport, Mich., 25th, 10.20 p. m. until midnight. St. Vincent, Minn., 21st, from dusk to 9.40 p. m.; 24th, 9 p. m. Yankton, 15th, 8.39 to 9 p. m. Clear Creek, Nebr., 17th and 18th.

OPTICAL PHENOMENA.

Mirage—Swanwick, Ill., 12th, visible nearly one hour. Northport, Mich., 1st, showing Torch Lake and its surroundings, situated in Antrim county, 14 miles to the eastward; the shore of Lake Michigan, two miles to the west and Beaver Islands and the highlands of Emmit county were distinctly visible. Umatilla, Or., 11th, the river, at a point about half mile below station, appeared elevated about 10 feet, apparently forming a water-fall. Indianola, 2nd, 15th, 16th, 19th and 23d. Manasquan, N. J., 6th, 1.50 p. m., ships were seen distinctly reflected upon the clouds along the New Jersey coast.

Lunar halos have been observed in the various districts on the following dates: New England, 7th; Middle Atlantic states, 2nd to 5th, 8th, 9th; South Atlantic states, 4th, 8th to 14th; Florida Peninsula, 1st, 4th, 5th, 8th, 11th; Eastern Gulf states, 10th, 13th; Western Gulf states, 2nd to 7th, 10th; Rio Grande valley, 7th; Ohio valley and Tennessee, 1st, 2nd, 3rd, 5th, 7th, 9th, 10th, 12th, 13th, 14th; Lower Lake region, 6th, 8th, 15th; Upper Lake region, 5th, 6th, 10th, 13th, 14th, 29th; Upper Mississippi valley, 2nd, 5th, 7th, 8th, 29th; Missouri valley, 1st, 30th; Northern Slope, 2nd, 3rd, 10th; Middle Slope, 30th; Northern Plateau, 7th; Southern Plateau, 28th.

Solar halos have been observed in the various districts on the following dates: New England, 19th; South Atlantic states, 9th, 19th; Ohio valley and Tennessee, 2nd, 3rd, 7th, 8th, 13th, 14th, 21st, 22nd; Lower Lake region, 1st, 4th, 6th, 14th, 22nd, 29th, 30th; Upper Lake region, 21st, 29th; extreme Northwest, 21st, 22nd; Upper Mississippi valley, 1st, 2nd, 8th, 13th, 14th, 21st 22nd, 29th; Missouri valley, 16th; Middle Slope, 1st, 12th, 13th, 16th; Northern Slope, 17th; Northern Plateau, 3rd, 7th, 21st, 26th; Middle Plateau, 17th, 27th; North Pacific region, 1st, 3rd, 7th, 16th, 28th; Middle Pacific region, 27th, 28th.

MISCELLANEOUS PHENOMENA.

Prairie and Forest Fires.—California: San Francisco, 14th, 3 p. m., considerable smoke was observed in the northwest, and at 5.39 p. m., the greater part of the sky was obscured, followed by occasional showers of ashes; at sunset the sky had a livid appearance, which caused much alarm until telegraphic reports gave information of heavy forest fires in Marin county. San Diego, 8th, 9th, 10th, 11th and 12th, brush fires in mountains. *Canada:* Great fires raging in the vicinity of Kingston, Ottawa, Gravehurst, Odessa and Bellville, Ontario, on the 3d. At Kingston, smoke very dense and business on the river almost at a standstill, boats being afraid to move. Gravehurst, several farm-houses and large barns with their contents burned. North of Bracebridge fires exceedingly destructive; several persons burned to death. Heavy brush fires between Ernstown and Collins Bay, on the line of the Grand Trunk Railroad; a large quantity of hay and stacks burned, also a number of barns and dwellings. The whole section is dark with smoke, the sun being shut out from view by a density of this element never before experienced; loss in this vicinity estimated at $80,000. Modoc Township, large amount of property destroyed, including dwellings, barns, crops, implements, fences, etc. The villages of Roslin and Sterling were burned up to on every side. Gravehurst, Ontario, 16th, the Woodstock Lumber Company's mills and 3,000,000 feet of lumber burned; west end of the town on fire, one church and six houses destroyed. Buffalo, 16th, thirty-five miles south of city fires very extensive, destroying dwellings and barns; telegraphic communication interrupted; burning trees across the track seriously impeded travel. *Dakota:* Yankton, 19th and 20th. *Indian Territory:* Ft. Gibson, 7th, 14th, 20th, 22nd, 23rd, 24th. *Texas:* Grierson Springs, 2nd to 5th; Bracketville, 5th. *Kansas:* Council Grove, 17th, extensive fires west of station, 700 tons of hay burned. *Michigan:* Port Huron, 6th, extensive fires along the lake shore and in the interior of Huron and Sanilac counties; entire county from Forestville to Port Austin in flames and the inhabitants fleeing for their lives. The small town of Port Hope entirely destroyed and many people burned to death; throughout this section the loss of farm and town property is immense. It is reported that the forests, covering miles in width, were one vast sheet of flame which traveled rapidly southward, destroying everything in its path; fires more disastrous than the great conflagration of 1871; 7th, the towns of Vassar and Minden have suffered severely but more particularly the surrounding country. Sanilac Co., 10th, 215 families have been burned out in the towns of Marlette, Flynn, Argyle, Evergreen, Moore, Lalotte and Elmer, and 92 persons burned to death. In general, the forest fires of Michigan swept over that portion of the State lying between Saginaw Bay to the north and Lake St. Clair on the south, stretching along the coast of Lake Huron for about 100 miles, and extending inland over a breadth of from 20 to 60 miles. From 500 to 1,000

persons were burned to death, and over 20 villages and hamlets containing a population of from 100 to 400 each, were completely destroyed; destruction of property three or four times greater than during the great fires of 1871. A vast cloud of smoke covered Lake Huron at its widest point (80 to 100 miles) with so dense a haze that navigation became extremely difficult and dangerous. "Tens of thousands" of dead birds were found floating upon the lake, besides which the waters were flecked with innumerable forest insects of all kinds. Neither the insects nor the birds appeared to be slain by the fire. In all probability they were driven by the heated atmosphere, flames and sparks to seek clear air over the lake, but finding none were lost in the smoky haze, probably injured by the foul air and finally dropped, tired out, into the water and drowned. Wild and domestic animals were destroyed in great numbers. In regard to an estimate of the losses incurred throughout the burnt district the following approximate calculation is given by counties: Ottawa Co., $829,428; Allegan Co., $116,500; Manistee Co., $706,600; Huron, Co., $553,818; Sanilac Co., $140,067; total $2,346,412. The following is a list of property destroyed, not including the thousands of acres of forest, many miles of fencing and immense quantity of farming implements: dwellings, 1,147; school houses, 28; churches, 8; hotels, 12; stores and offices, 130; mills, 34; docks, 20. *New Jersey:* Trenton, 2nd, the Blue mountains were blazing for miles; dense smoke obscured the sun for several days; heat intense. *New York:* Batavia, 3rd, large wooded swamp on fire and spreading for miles; two houses and several barns burned. Mc Kean and Allegheny counties, 3rd, thousands of acres burned over, with almost an incalculable loss of property; hundreds of men watched day and night for fresh outbreaks and attempted to prevent the fires spreading. About 40 oil rigs and 10,000 barrels of oil were destroyed. Albany, 3rd, the air is so dense with smoke in some localities that it is difficult to breathe and it hangs like a pall over city and country for hundreds of miles. In the southwestern portion of the state miles and miles of forests and fields are on fire with very heavy loss. Sullivan Co., 3rd, on the Mendall and Eldred R. R., woods burning for miles, inflicting great loss upon the petroleum operations in that vicinity. Rixford, 3d, miles of forest in one great sheet of flame, sweeping everything in its course; roar could be heard for several miles; great loss at the oil wells, 21 tanks and 140,000 barrels of crude oil destroyed. Rome, 3d, fires still continue along the Watertown and Ogdensburg Railroad, and the Midland Railroad; railroad ties, fences, telegraph poles and bridges have been destroyed. St. Johnsville, 3d, fires raging over thousands of acres to the north of station, and the smoke is so dense that it is impossible to distinguish objects at a distance of 200 hundred yards. Utica, 3d, smoke so dense that all business was for a time interrupted; objects could not be distinguished a distance of 40 rods; railroad engines moved slowly along the tracks and all communication was seriously interrupted. Sanquoit, 3d, woods burning on all sides, great destruction to timber and farming property. New York Mills, 3d, heavy forest and brush fires to the south; air for miles about filled with dense smoke, interrupting business. New Hartford, 3d, forest fires south of station; great destruction of fencing and timber. Paris Hill, 3d, hundreds of acres of forest burned, fires still raging. Fort Ann, 3d, near the northwest part of the town, on what is known as "Buck Mountain," air so charged with smoke that every house in the town seemed full of it. Oswego Falls, 20th, hundreds of acres of swamp burning, filling the air with dense smoke for miles around. Pulaski, 19th, one house destroyed; underbrush and stubble-fields burning. Parish 19th, the "big woods" on fire; several farm buildings destroyed. Carthage, 19th, terrible destruction of farm property; many families lost everything; the country for miles is swept of all buildings and every species of vegetation; men, women and children suffering severely from smoke and loss of sleep, having fought fire night and day for the past two weeks. Carterville, 19th, fires raging terribly; all people in surrounding country have goods packed ready for flight. Daysville, 19th, great destruction of timber. Howardville, 19th, woods for miles about on fire; several barns and shanties burned. Orwell, 21st, fifteen fires visible at one time; immense destruction of timber. Kasoag, 17th, fires raged incessantly for the past 15 days; railroad company lost 2,500 cords of wood; smoke so dense that railroad traffic has been suspended; several miles of track badly damaged; ties burned from under the rails and the latter warped by the extreme heat. Constantia, 17th, town gradually burning up; extreme loss of farm and household property. Cleveland, 17th, fires raging to the north and west, with extreme violence; forests, cordwood, barns, fences and houses destroyed in the path of the fire; miles and miles of country converted into a blackened waste. Mexico, 17th, hundreds of acres of forest burned over; loss on farm buildings about $5,000. Hannibal, 17th, numerous fires about the town; several buildings destroyed. *Pennsylvania:* Clarendon, 3rd, raging with great vehemence; the whole oil country in danger; railroad companies have wreckers on duty day and night fighting the fire. Franklin, Erie Co., 3rd, a strip of country, five miles long and one mile wide, burned over, destroying hundreds of hay and wheat stacks, several houses and many out-buildings. Loss on buildings over $30,000, while that on crops and timber cannot be estmated. *Utah:* Salt Lake City, 3rd, 4th, in mountains. *Montana:* Superior City, 14th, 15th.

Foggy or Smoky Atmosphere.—This condition of the atmosphere became quite general from the 1st to the 10th, over that portion of the United States included between the meridians of 67° and 87°W. and the 40th and 45th parallels. It reached an unusual culmination in density on the 6th

in the eastern portion of the Middle Atlantic states and throughout New England, where it interrupted the prosecution of business to such a degree as to compel the necessity of artificial light in the factories, stores and other similar places. It will be seen upon referring to the paragraph headed "Prairie and Forest Fires," that their destructive violence throughout northern Michigan and portions of Canada has perhaps never been exceeded and that the intensity of the accompanying smoke was simply dreadful. On this day southwesterly winds prevailed from Tennessee northward to Lake Superior and thence eastward to the Canadian Maritime Provinces and smoke was reported as far south as Knoxville, westward to Milwaukee, northward to Rockliffe, Canada, and eastward to New Brunswick. To show the progess eastward of this element in the atmosphere it is necessary to trace the movement of low pressure areas over Canada and northern New England, and watch the accompanying change in wind directions. With the prevalence on the 1st of a low pressure area, (0.20 to 0.50 inch below the normal,) over the Middle Atlantic States and New England accompanied by south to southwest winds, smoke was reported from nearly every station between Detroit and Eastport, and as far north as Rockliffe. By afternoon of the 2d the low area had passed off the Nova Scotia coast followed over New England by winds shifting to north and northeast and a complete clearing away of the smoke. During the 3d smoke was only reported from western Canada and the Lower Lake region. By afternoon of the 4th, through the influence of an approaching area of low pressure over Canada, the winds again shifted to southerly in the Middle Atlantic states and eastern New England, followed by the reappearance of smoke as far north as Rockcliffe and eastward to Mt. Washington. As the area continued its eastward movement over northern Canada the winds shifted to the west driving the smoke eastward, so that by the morning of the 6th the latter covered the whole of New England except Maine. During the morning of the 7th it reached New Brunswick, extending thence southwestward to Lake Michigan. By morning of the 8th the low pressure previously referred to passed off the Nova Scotia coast, followed over New England by winds shifting to north and northwest and a disappearance of the smoke, stations generally, reporting clear or partly cloudy weather. The following collection of data referred to States, shows to some extent the intensity and peculiar effects of the phenomenon: *Canada:* Montreal, 6th, 7th, very dense smoke. *Connecticut:* Norwich, 6th, gas in many places of business lighted at midday. In some of the Cape towns cattle ceased feeding and hens went to roost. Putnam, 6th, lamps lighted at midday, schools closed and business generally suspended except where gas or lamps were used. Woodstock, 6th, during most of the day business carried on by the aid of gas or lamps; schools closed. Hartford, 6th, business generally suspended; houses lighted by gas or lamps during the day; atmosphere of a yellowish cast. *Massachusetts:* Boston, 6th, a remarkably yellow condition of the atmosphere began to form about 5 a. m., composed partly of fog, but mostly of smoke, occupying the elevated regions of the atmosphere; no unusual smell accompanied the phenomenon. The air was loaded with dampness and the breeze was so gentle that for several hours the smoke arising from the city and factories hung about the lower strata of air, passing very slowly seaward and occasionally rising to a sufficient altitude to intensify the peculiar darkness. At times the glare of this peculiar condition of the sky was very painful to the eyes and in the open air all brilliant colors, and particularly those in direct contrast with yellow appeared under very strange hues. Grass turned dark and dull and delicately colored flowers faded until their colors became blended. Stars were visible in the zenith at 8 a. m. Dukes Island, Nantucket and Cape Cod, 6th, reported darkness during most of the day as very marked, seriously affecting business, except where lamps were made use of. Springfield, 6th, day opened with a dense fog suspended at a considerable elevation; there appeared to be present with the fog a peculiar substance giving to the whole mass a strange yellow color. The color of surrounding objects was remarkably affected. Spectrum analysis revealed the fact that that the blue end of the spectrum as far as, and including the violet, was almost entirely absent. The phenomenon had a strange effect upon gas lights, giving them the appearance of small electric lights, while the latter had a blue color. It was perfecily calm most of the day and the humidity was very high. Fall River, 6th, 9 a. m., stores and residences lighted; in all the mills and factories lights were burned; public schools were closed. North Adams, 6th, mills and stores were lighted during the forenoon; about 11 a. m. air grew clearer, and by noon the sun shone like a brilliant pink ball; for a time the heat was very oppressive. In some of the neighboring towns the female mill operatives became so frightened by the peculiar appearance that they stopped work and fled to their homes; streets were crowded with excited people, who believed that the "day of judgment" was at hand. Salem, 6th, no such atmospheric peculiarity since the famous dark day of May 19th, 1780; all stores on Essex street brilliantly lighted at noon, also the great mills of the Naumkeag Steam Cotton Company. Lynn, 6th, many factories closed early in the afternoon; business quite generally suspended. *Michigan:* Port Huron, 1st, heavy fog at daybreak; during the day lower atmosphere filled with dense smoke, which continued on the following dates: 2d, 3d, 6th to 8th, 10th, 21st. *New Hampshire:* Nashua, 6th, in the morning artificial light was necessary for all kinds of outdoor business; gas-light had the appearance of an electric light, and grass and foliage was of a bright green hue. Hanover, 6th, in the morning the sky overhead was of a light olive, shading off all around to a decided green at the horizon. The light

was of a pronounced yellowish green, intensifying the green color of the grass, trees, etc., while houses painted white showed more distinctly a yellowish hue. Contoocook, 6th, lamps were lighted at midday; schools were closed and business generally suspended. *New York:* Albany, 6th, 5 a. m., a few stratus clouds in the lower atmosphere together with what appeared to be light smoke, the latter gradually increased in density until 7.30 a. m. when the entire heavens were hidden and from 8 to 9.40 a. m. it was so dark that artificial light was necessary to enable business to be transacted. The color of the atmosphere was yellow or light brown as the density of the smoke appeared to increase or decrease and a remarkable effect was produced on all objects upon the earth's surface. Grass and all objects of green color were made to appear unusually bright, while blue was changed to purple or pink. The smoke did not extend immediately to the earth's surface, but hung as a cloud of low elevation. No smell of smoke was detected at any time; the sky became clear at 11.30 a. m. *Tennessee:* Knoxville, 7th, peculiar haze through which the reflected light of the sun gave strange effect to various objects. *New Jersey:* Freehold, 8th, very smoky all day; sun could be seen with naked eye without pain; at night moon very red. *North Carolina:* Weldon, 7th, sun in early morning obscured by a peculiar haze in the atmosphere through which the light shone with a perfect pink color, a condition which it maintained all day. The light when passsing through a door or window cast a purple colored shadow on the floor; 8th, similar conditions prevailed; smoke more dense; by 2 p. m. sun entirely obscured. *Rhode Island:* Providence, R. I., 6th, supply of gas gave out early in the afternoon and the whole city was left in almost complete darkness. Block Island, 6th, day very dark, atmosphere of a yellowish hue. Point Judith, 6th, densely foggy until 10 a. m,, when the atmosphere assumed a yellowish tinge and was perfectly calm; surrounding objects appeared as if viewed through colored glass and artificial light became necessary in order to perform work in doors. Phenomenon continued until 4 p. m., after which it gradually dissipated. Newport. 6th, very dense fog in the morning, which, at about 10 a. m., changed to a yellowish color and lifted a short distance above the earth's surface. This peculiar cloud increased in density and the color become a deeper yellow; sometimes it was tinged with pale green or light brown. Grass and trees were of a deeper green color and sunflowers appeared to be white. From 1.30 to 4.30 p. m., artificial light was necessary to the performance of business; at 5 p. m., it gradually grew lighter; 8 p. m., moon came out very red, but in the course of an hour assumed its natural appearance; air calm most of the day. *Vermont:* Bellows Falls, 6th, so dark that at the hotels and private residences breakfast and dinner were partaken of by lamp light; offices and stores were lighted and lamps were used in railroad trains. The sun shone quite bright in the afternoon.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty four hours have been observed at all Signal Service stations. Reports from 181 stations show 5,398 observations to have been made, of which 22 were reported doubtful; of the remainder, 5,376, or 84.6 per cent., were followed by the expected weather.

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent, Nautical Almanac Office, Washington, D. C:

Date— Sept. 1881.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
7, 10 a. m	.....	.....	.....	.....	.....	.....	4	25†	
8, 3 p. m	0	0	1	5	0	0	3	20†	
13, 11 a. m	.....	.....	.....	.....	.....	.....	4	3 †	
14, 12 m	0	0	0	0	0	0	4	3 †	
15, 4 p. m	0	0	0	5	0	0	4	25†	
16, 12 m	0	0	2	5	0	0	2	20†	
17, 9 a. m	0	5	0	0	0	0	1	25†	
18, 3 p. m	2	5	0	0	1	3	3	25†	
19, 11 a. m	0	0	1	5	0	0	2	20†	
20, 9 a. m	0	0	0	0	0	0	2	15†	
21, 12 m	0	0	0	0	0	0	2	12	
24, 12 m	0	0	.....	.....	0	0	2	5	
25, 1 p. m	1	1	1	3	1	1	2	3	
27, 11 a. m	2	4	0	0	0	0	4	7	
28, 2 p. m	1	2	0	0	0	0	5	9	
30, 3 p. m	0	0	0	0	0	0	5	9	

†Approximated. Faculæ were seen at the time of every observation.

Mr. H. D. Gowey, at North Lewisburg, Ohio, reports: sun spots were observed on every clear day during the month: they were most numerous on the 1st and 19th; the largest were observed during last of month. Mr. David Trowbridge, at Waterburg, N. Y., reports as follows: 1st, 3 groups, 15 spots; 3rd, 2 groups, 7 spots, dense fog interfered with observation; 4th, 1 group, 4 spots, 1 group disappeared by rotation; 5th, 2 groups, 5 spots, a new group, of 2 spots has appeared; 6th, 4 groups, 5 spots, 2 new groups; 7th, 2 groups, 5 spots, 2 groups observed on 5th, disappeared; 10th, 1 group, 3 spots; 12th, 4 groups, 12 spots, 1 new group near west side, must have arisen since the 10th, 1 appeared by rotation, and the appearance of a third group is not

accounted for; 13th, 4 groups, same as observed on 12th, 15 spots; 14th, 4 groups, 13 spots, 1 large spot has disappeared; 15th, 4 groups, 9 spots; 16th, 1 group, 4 spots, 2 groups have disappeared by rotation, and one gone out; 17th, 1 group, 4 spots, same as 16th; 18th, 1 group, 7 spots; 19th, 2 groups, 5 spots, 1 new group appeared by rotation, faculae near; 21st, 2 groups, 4 spots, same as observed on 19th; 22d, 2 groups, 2 spots; 23rd, 2 groups, 2 spots, same as observed on 22d; 25th, 1 group, 2 spots, the west group has disappeared by rotation; 26th, 2 groups, 3 spots, 1 new group has appeared by rotation; 28th, 29th, 2 groups, 2 spots, same as observed on 26th; 30th, 3 groups, 3 spots, 1 new group has arisen near middle of disk.

Meteors.—Prescott, Ariz., 8th, remarkably brilliant; was observed falling from a point in southwestern heavens, about 30° above the horizon; it moved in a westerly direction and left in its trail a train of sparks resembling those emitted from an exploded rocket. North Platte, Neb., 26th, 7.20 p. m., seen in northwestern sky; it left a trail of white and light-bluish color, and exploded into three distinct fragments. Davenport, Ia., 24th, 11 p. m., very brilliant. Burlington, 24th, 9.25 p. m., having the appearance of a signal rocket; color, bluish white with dark blue near centre; exploded and left a track of deep crimson. Somerville, N. J., 13th, 9 p. m., in the west, descended slowly with a curve and exploded like a rocket. Hector, N. Y., 13th, in appearance about the size of the full moon, appeared in the southern heavens, moved downward, leaving heavy trail of light and illuminated the whole heavens; flight lasted six seconds.

Polar Bands.—Portland, Or., 3rd and 7th. Mobile, 9th. New Corydon, Ind., 2nd, 8th, 14th, 18th and 21st. Clinton, La., 9th. Guttenburg, Ia., 17th and 18th. Yates Centre, Kan., 7th, 12th, 13th, 28th and 30th. Gardiner, Me., 17th and 28th. Thornville, Mich., 14th. Fayette, Miss., 1st, 6th, 9th. Auburn, N. H., 29th. Wytheville, Va., 19th.

Earthquakes.—Angel Island, 18th, 5.15 p. m., slight shock. San Francisco, 18th, 5.20 p. m., severe shock, vibration from west to east; duration five seconds; no damage reported other than slight breakage to crockery.

Sand-storms.—Winnemucca, 22nd; Brackettville, Tex., 4th and 5th; Ft. Yuma, 17th and 26th.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Brig. & Bvt. Maj. Gen'l,
Chief Signal Officer, U. S. A.

Copy furnished for

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WAR DEPARTMENT
SIGNAL SERVICE, U.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BEN
II
V
VII
VI
IV
Indianola 2
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.
No. | Velocity.
I. 49 miles per hour.
II. 41 do.
III. 15 do.
IV. 25 do.
V. 24 do.
VI. 37.5 do.
VII. 30 do.
TRACKS OF CENTRES OF AREAS OF
PUBLISHED BY ORDER OF
BRIG. & BVT. MAJ. GEN'L. CHIEF

No. I.

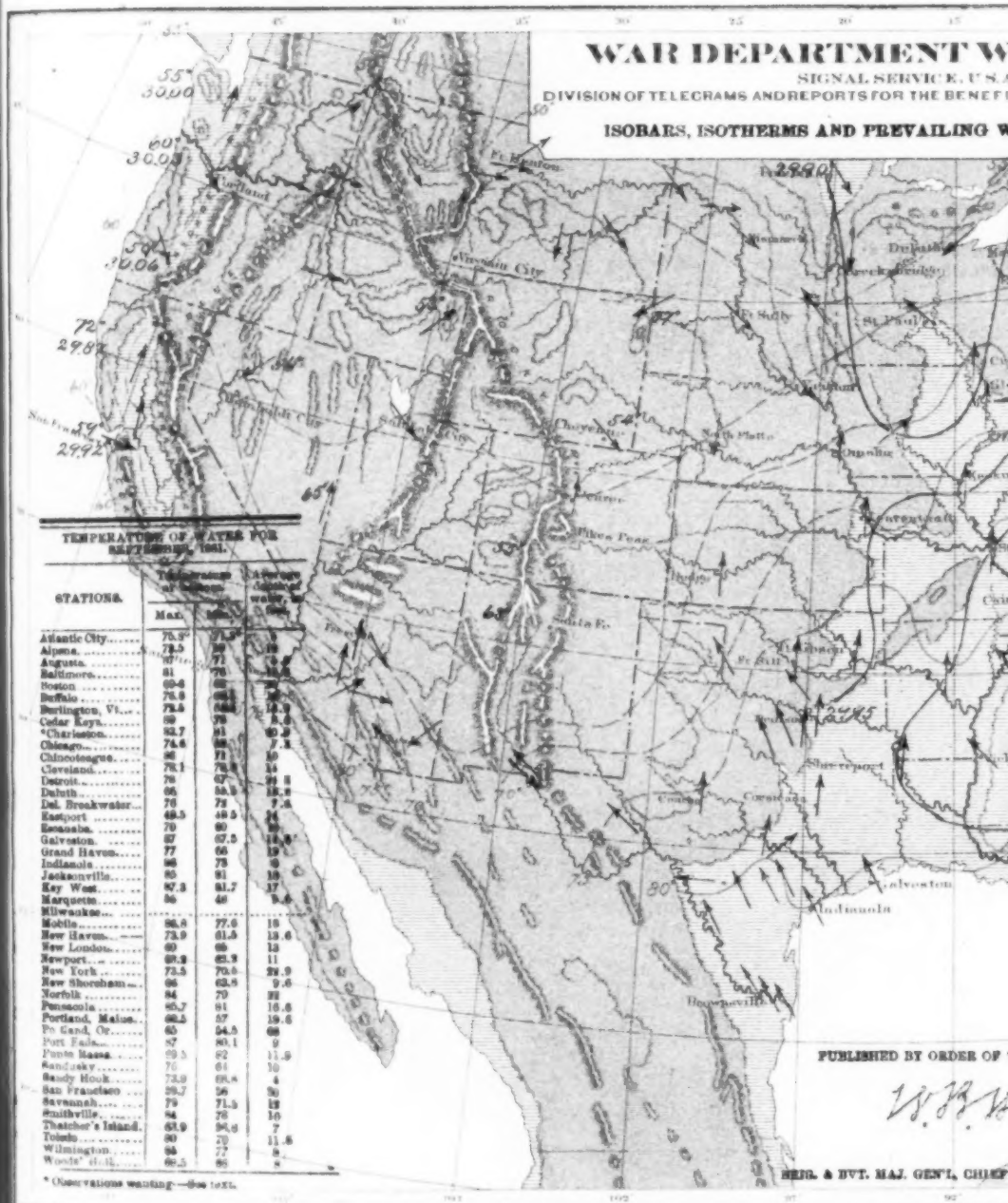
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report written respectively above and below the line.

EAS OF LOW BAROMETER FOR SEPTEMBER, 1881.

ORDER OF THE SECRETARY OF WAR

W. B. Hazen

EN'L, CHIEF SIGNAL OFFICER U. S. A.


WAR DEPARTMENT W
SIGNAL SERVICE, U.S.A.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFI
ISOBARS, ISOTHERMS AND PREVAILING W
PUBLISHED BY ORDER OF
BRIG. & BVT. MAJ. GEN'L, CHIEF

TEMPERATURE OF WATER FOR SEPTEMBER, 1881.

STATIONS.	Temperature of Water. Max.	Min.	Average temperature of water, 8 A.M.
Atlantic City	76.5°	71.5°	5
Alpena	73.5	59	10
Augusta	87	77	9
Baltimore	81	70	10.5
Boston	69.6	62	7
Buffalo	73.6	63.5	10
Burlington, Vt.	72.5	60	12.5
Cedar Keys	92	78	13.5
*Charleston	83.7	71	9.5
Chicago	74.6	66	7.5
Chincoteague	86	71	10
Cleveland	78.1	70.5	14
Detroit	76	67	10.5
Duluth	66	54.5	12.5
Del. Breakwater	76	73	7.5
Eastport	68.5	48.5	14
Escanaba	70	60	10
Galveston	87	67.5	14.5
Grand Haven	77	66	13
Indianola	86	75	9
Jacksonville	85	81	10
Key West	87.3	81.7	17
Marquette	56	49	5.4
Milwaukee			
Mobile	86.8	77.6	16
New Haven	73.9	61.5	13.6
New London	69	60	13
Newport	69.2	62.9	11
New York	73.5	70.5	21.9
New Shoreham	66	62.8	9.6
Norfolk	84	70	22
Pensacola	85.7	61	16.6
Portland, Maine	68.5	57	19.6
Po Gand, Or	65	54.5	68
Port Eads	87	80.1	9
Punta Rassa	93.5	82	11.5
Sandusky	76	61	10
Sandy Hook	73.9	69.8	4
San Francisco	70.7	56	50
Savannah	79	71.5	13
Smithville	84	76	16
Thatcher's Island	63.9	56.6	7
Toledo	80	70	11.5
Wilmington	84	77	8
Woods' Holl	68.5	66	8

* Observations wanting—See text.

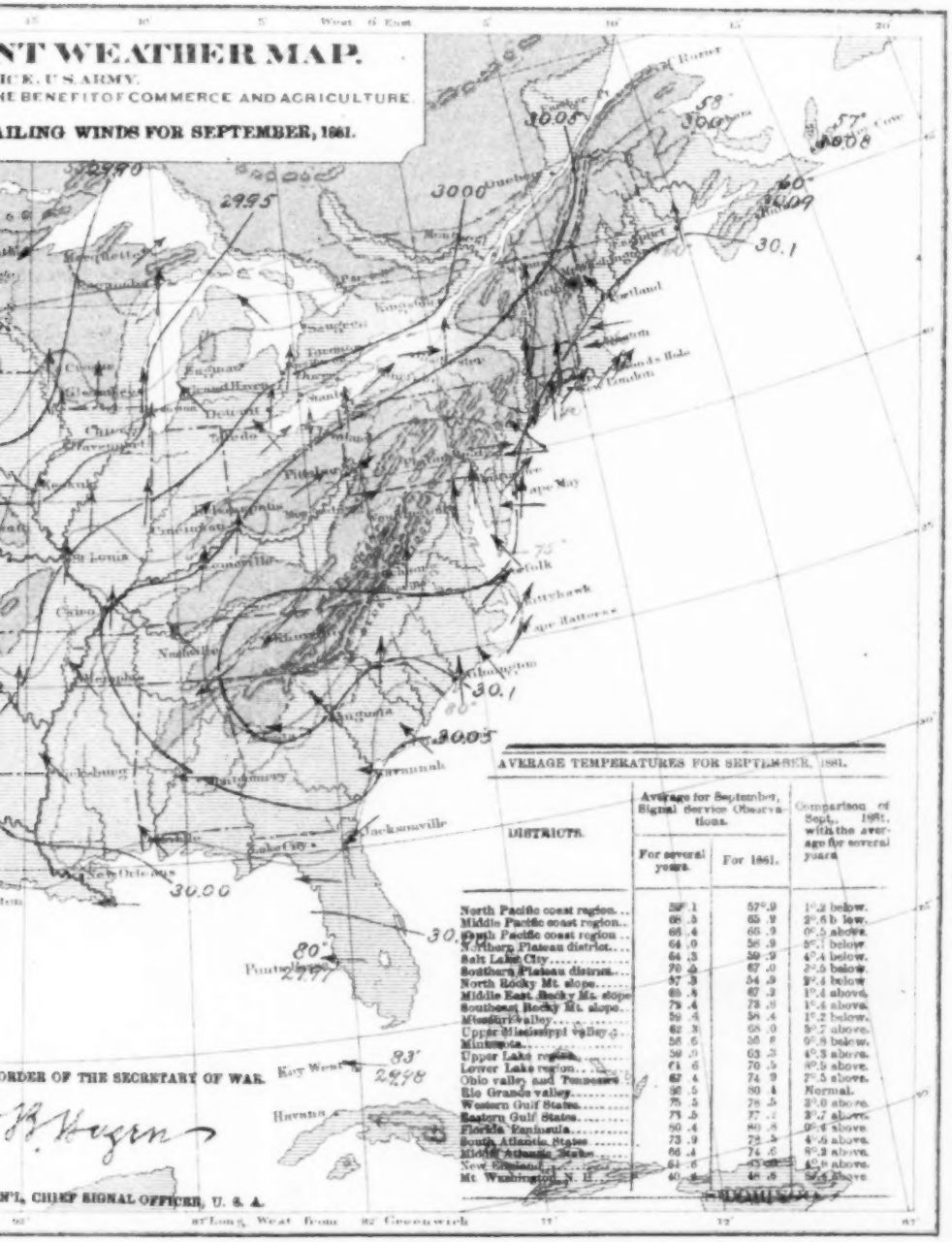
No. II.

NT WEATHER MAP.

IC E. U S ARMY.

HE BENEFIT OF COMMERCE AND AGRICULTURE.

AILING WINDS FOR SEPTEMBER, 1861.



ORDER OF THE SECRETARY OF WAR.

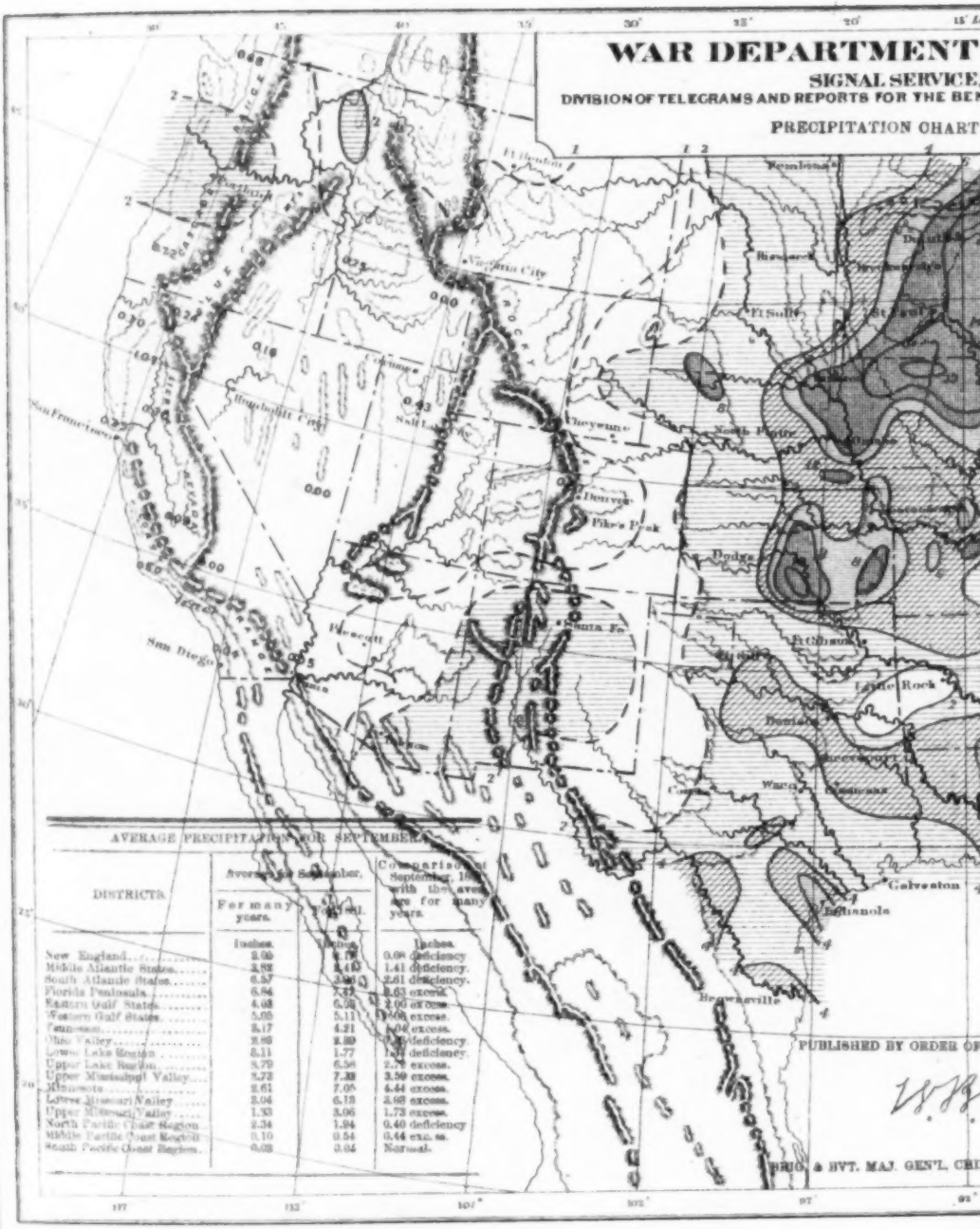
B. Hagner

T, CHIEF SIGNAL OFFICER, U. S. A.

AVERAGE TEMPERATURES FOR SEPTEMBER, 1861.

DISTRICTS.	Average for September, Signal Service Observations. For several years.	For 1861.	Comparison of Sept., 1861, with the average for several years
North Pacific coast region	58°.1	57°.9	1°.2 below.
Middle Pacific coast region	66 .3	65 .9	2°.6 b low.
South Pacific coast region	66 .4	66 .9	0°.5 above.
Northern Plateau district	64 .0	58 .9	5°.1 below
Salt Lake City	64 .3	59 .9	4°.4 below.
Southern Plateau district	70 .5	67 .0	3°.5 below.
North Rocky Mt. slope	57 .3	54 .9	2°.4 below
Middle East. Rocky Mt. slope	66 .8	67 .3	1°.4 above.
Southeast. Rocky Mt. slope	73 .4	73 .8	1°.4 above.
Missouri valley	59 .6	58 .4	1°.2 below.
Upper Mississippi valley	62 .3	68 .0	5°.7 above.
Minnesota	58 .6	58 .6	0°.0 below.
Upper Lake region	59 .0	63 .5	4°.5 above.
Lower Lake region	74 .6	70 .5	4°.5 above.
Ohio valley and Tennessee	67 .4	74 .9	7°.5 above.
Rio Grande valley	80 .5	80 .4	Normal.
Western Gulf States	75 .5	78 .5	3°.0 above.
Eastern Gulf States	79 .5	77 .4	2°.7 above.
Florida Peninsula	80 .4	80 .8	0°.4 above
South Atlantic States	73 .9	78 .5	4°.6 above.
Middle Atlantic States	66 .4	74 .6	8°.2 above.
New England	64 .6	63 .0	1°.6 above.
Mt. Washington, N. H.	40 .8	46 .8	6°.0 above

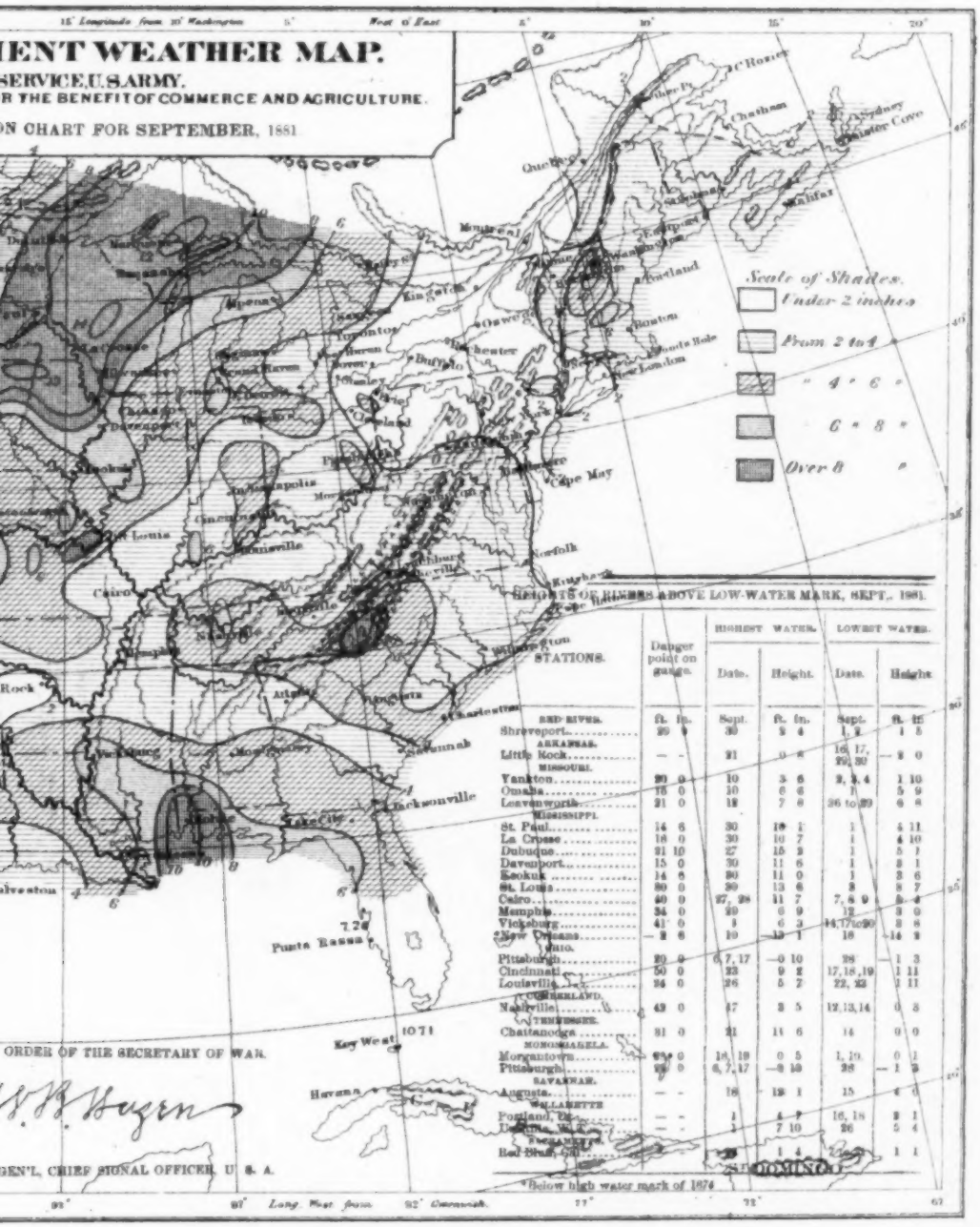
87° Long. West from 82° Greenwich



AVERAGE PRECIPITATION FOR SEPTEMBER.

DISTRICTS.	Average for September. For many years.	Fall for September, 1881.	Comparison of September, 1881, with the average for many years.
	Inches.	Inches.	Inches.
New England	3.00	1.77	0.08 deficiency.
Middle Atlantic States	3.82	2.41	1.41 deficiency.
South Atlantic States	6.57	3.96	2.61 deficiency.
Florida Peninsula	6.84	7.47	0.63 excess.
Eastern Gulf States	4.03	6.03	2.00 excess.
Western Gulf States	5.05	5.11	0.06 excess.
Tennessee	3.17	4.21	1.04 excess.
Ohio Valley	2.80	1.89	0.91 deficiency.
Lower Lake Region	3.11	1.77	1.34 deficiency.
Upper Lake Region	3.79	6.38	2.59 excess.
Upper Mississippi Valley	3.72	7.22	3.50 excess.
Minnesota	2.61	7.05	4.44 excess.
Lower Missouri Valley	3.04	6.13	3.09 excess.
Upper Missouri Valley	1.33	3.06	1.73 excess.
North Pacific Coast Region	2.34	1.94	0.40 deficiency
Middle Pacific Coast Region	0.10	0.54	0.44 exc. ss.
South Pacific Coast Region	0.03	0.04	Normal.

No. 111.



HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, SEPT., 1881.

STATIONS.	Danger point on gauge.	HIGHEST WATER. Date.	HIGHEST WATER. Height.	LOWEST WATER. Date.	LOWEST WATER. Height.
RED RIVER.	ft. in.	Sept.	ft. in.	Sept.	ft. in.
Shreveport	20 0	30	5 4	1, 2	1 5
ARKANSAS.					
Little Rock	— —	21	0 8	16, 17, 29, 30	2 0
MISSOURI.					
Yankton	20 0	10	3 6	2, 3, 4	1 10
Omaha	18 0	10	6 6	1	5 9
Leavenworth	21 0	12	7 8	26 to 29	6 8
MISSISSIPPI.					
St. Paul	14 6	30	10 1	1	4 11
La Crosse	18 0	30	10 7	1	4 10
Dubuque	21 10	27	15 2	1	5 1
Davenport	15 0	30	11 6	1	3 1
Keokuk	14 6	30	11 0	1	2 6
St. Louis	30 0	30	13 6	2	3 7
Cairo	40 0	27, 28	11 7	7, 8, 9	5 4
Memphis	34 0	29	6 9	12	3 0
Vicksburg	41 0	1	6 3	14, 17 to 30	3 8
*New Orleans	— 2 6	10	1 1	16	14 2
OHIO.					
Pittsburgh	20 0	6, 7, 17	0 10	28	1 3
Cincinnati	50 0	23	9 2	17, 18, 19	1 11
Louisville	34 0	26	5 7	22, 23	2 11
CUMBERLAND.					
Nashville	49 0	17	3 5	12, 13, 14	0 8
TENNESSEE.					
Chattanooga	31 0	21	11 6	14	0 0
MONONGAHELA.					
Morgantown	25 0	18, 19	0 5	1, 29	0 1
Pittsburgh	22 0	6, 7, 17	—0 10	28	— 1 3
SAVANNAH.					
Augusta	— —	18	12 1	15	4 6
WILLAMETTE					
Portland, Or.	— —	1	4 7	16, 18	2 1
Umatilla, W. T.	— —	1	7 10	26	5 4
PENOBSCOT.					
Bel-Brush, Me.	— —	29	1 4	22	1 1

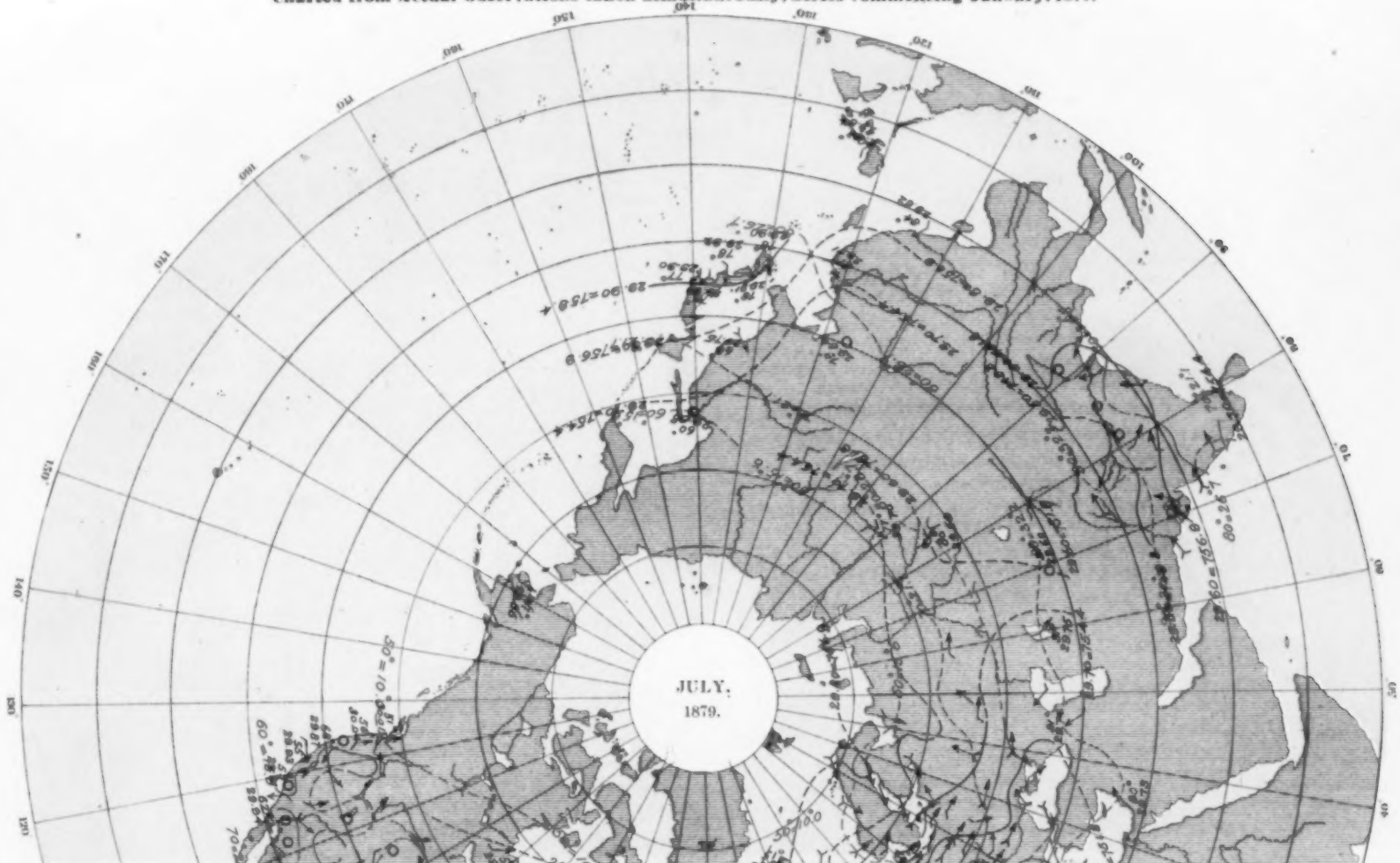
*Below high water mark of 1874

Office of the Chief Signal Officer,

UNITED STATES ARMY.

No. V.

Charted from Actual Observations taken Simultaneously, Series commencing January, 1877.



PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind. Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
○	0	0	0
→	1, 2	0 to 9	0 to 4.0
→	3, 4	9.1 to 22.5	4.1 to 10.1
→	5, 6	22.6 to 40.5	10.1 to 18.1
→	7, 8	40.6 to 67.5	18.1 to 30.2
→	9, 10	67.6 up.	30.2 & over.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

W. B. Hazen

Brig. & Bvt. Maj. Gen'l,
Chief Signal Officer, U. S. A.

ISOBARS AND ISOTHERMS.

Isobars in *blue;* detached barometer means in English inches.

Isotherms in *red;* detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART.

Showing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of July, 1879, based on the daily charts of the International Bulletin

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing November, 1877. **No. VI.**

Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR

W. B. Hazen

Brig. & Bvt. Maj. Gen'l,
Chief Signal Officer, U. S. A.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for October, 1879.